FOUNDRY TRADE JOURNAL

Established 1902

Vol. 93 Thursday, October 2, 1952 No. 1883

PRINCIPAL CONTENTS

	PAGE
Features	
Leader: Germany Revisited	375
Leaders of the Industry: Noël P. Newman	376
Notes from the Branches	378
Film Review	384
Forthcoming Events (Advert. section)	27
Technical	
I.B.F. National Works Visits	379
Some Effects of Magnesium on the Formation of Graphite in a Solidifying Cast Iron, by I. C. H. Hughes	385
Brassfoundry Finishing Methods, by F. Wild	393
Production Methods in Vitreous Enamelling—Discussion	397
News	
A Noteworthy German Bronze Foundry	378
Controlled Prices Exceeded	378
Personal	383
Hanging of Bells	384
Obituary	384
News in Brief	402
Raw Material Markets	404
Statistics	
Pig-iron and Steel Production	392
Current Prices of Iron, Steel, and Non-ferrous Metals (Advert. section)	26

PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s., Abroad 45s. (Prepaid).

49 Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Germany Revisited

Any visitor to Germany after an interval of 15 years cannot fail to be impressed by the destruction wrought by the war and by the rapidity and the extent of the rehabilitation effected. The public has been well informed as to the damage suffered but we, no doubt like many others, lacked first-hand information as to the extent recovery had been made. Obviously, in the course of a quite short visit we could but get a picture, and that a somewhat sketchy one, of the foundry industry. The occasion was participation as a guest at the 43rd general meeting of the Verein Deutsche Giessereifachleute—that is the German foundrymen's technical association. Our first engagement was to a luncheon party at the " Foundry House " —a beautiful new building which houses the employers' federation and the technical institute. The former has a staff of about 35 and the latter, including the editorial staff of *Giesserei* about seven or eight. Here, guests were very cordially received by the president, Mr. Küster and the director, Dr. Hugo. After luncheon the first session opened without ceremony and with a lecture on hot-blast cupolas.

The German technical association has just over 2,000 members, it was confidently expected that for the annual general meeting held on the following day 1,000 members would be present, and for the supper party held that evening in the Rheinhalle, formerly the Planetarium, no fewer than 1,200 members and their guests would be present. Surely this must be the greatest gathering of foundrymen ever held in Europe! Of general matters it was learnt that trade was good; that Sandslingers were not used so much in Germany as in America; that the Croning process was still feeling its way; that flexible cutting-off wheels were being made in Germany. Later, however, talks with other foundrymen made us not so certain whether such wheels really existed in Germany. The cement-moulding process was highly developed and real progress was being made with hot-blast cupolas. Phenol resins were not as yet being extensively used.

Practically all foundry owners in the western part of Germany—iron, steel, non-ferrous and light alloy—were in one big employers' association, paying as subscription a percentage of the wages bill or some similar arrangement. Countries which have such an integration of foundry sectional interests, particularly France and Germany, do seem to blossom forth as substantial property owners, instead of being spread all over the country as is the case here and in America. Finally to our hosts we express our sincere thanks for their very courteous reception and generous hospitality accorded to us.

NOËL P. NEWMAN

Chairman and Managing Director of Newman, Hender & Company, Limited, Vice-president of the Joint Iron Council and Chairman of the Council of Ironfoundry Associations.

Leaders of the Industry

MR. N. P. NEWMAN, J.P.

THERE are but few personalities in the foundry industry who are better known than Mr. Nöel P. Newman, J.P., whose portrait appears on the facing page. He has for a number of years been prominent in both ferrous and non-ferrous employers' associations and in technical circles. His first public appearance was in 1936 as a lecturer to the London branch of the Institute of British Foundrymen, when he dealt with the subject of coremaking. At that time he was assisting his father, the late Mr. C. P. Newman, then chairman and managing director of Newman, Hender & Company, Limited, of Woodchester, Gloucestershire, in the direction of this well-known firm of valve makers. He was fortunate in being associated with a progressive works beautifully located at the side of a lake.

It may have been the geographically isolated situation of his works that caused Mr. Newman to attach great importance to employer and technical co-operation, and he has during the last ten years in no small measure helped to convert a collection of both national and local bodies interested in ironfounding into an integrated whole, known as the Council of Ironfoundry Associations, over which he presides with great distinction. The stimulus so provided has in a considerable degree not merely overcome much ill-founded suspicion, but has created many lasting friendships.

Mr. Newman has also done his best to advance technology and, on the formation of the Bristol branch of the Institute of British Foundrymen, became its representative on the General Council, where his oratorical gifts and abundance of common sense soon resulted in his election to the presidential chair. This he occupied in 1949 at a most enjoyable conference held in Cheltenham—the town in which Bessemer chose to make known his epoch-making method of steel production. Unlike only too many past-presidents of associations, Mr. Newman retains his interest in the Institute, as he is now its honorary treasurer. Moreover, again unlike many prominent industrialists, he accords to his staff every opportunity to participate fully in technical and business associations and, indeed, one of them is now presiding over the Association of Bronze and Brass Founders, whilst others have been members of productivity teams. Mr. Newman's other activities include the vice-presidency of the Engineering Employers' West of England Association, and the chairmanship of the British Valve Manufacturers' Association and the West of England Ironfounders' Association.

Mr. Newman is an enthusiastic advocate for the industry he serves. To use his own words, it is something to be proud of that within such a comparatively short time prejudices have been removed and founders can sit down together and discuss mutual problems, visit each other's plants and participate in such things as productivity teams, cost groups, and training schemes.

Noteworthy German Bronze Foundry

Last week, during a visit to Germany, our representative was invited by Dr. Ing. Günther Schwietzke to visit his foundry J. G. Schwietzke in the north of Düsseldorf (446 Münsterstrasse). This a particularly well-equipped non-ferrous foundry, specializing in the manufacture of corrosion-resisting castings; centrifugal castings in water-cooled moulds; and sand castings weighing from a few ounces up to 12 tons. The outstanding feature of the works is undoubtedly the centrifugal-casting department, where vertical and horizontal machines only are used. In this department, metal is melted in large, high-frequency, electric furnaces, and transferred to an electrically-heated holding furnace. An automatically-controlled tilting mechanism allows a predetermined, adjustable quantity of metal to enter into the pouring ladle. Thereafter the method is much the same as the well-known de Lavaud system.

In the heavy foundry sand-moulds dried in town's-gas-fired stoves are used for the making of quite large aluminium-bronze castings. Stainless-steel castings are also being turned out regularly. At one time Monel metal was exclusively used, Dr. Schwietzke having learnt the technique when a young man in the foundries of J. & G. Weir of Glasgow. The sand preparation is automatic, using a batch mill of the Simpson type, and a smaller one externally resembling a Fordath mixer for the preparation of oil-sand cores. The properties of the sand are, as are all metal mixtures, laboratory controlled in an extremely well-equipped department. In the sand-preparing shop, there is a metal-recovery plant, and the waste from this is sold for further treatment. The light moulding shop is mechanized but not fully so. Use is made of a mould-coating of British origin.

In the fettling shop it was hoped to see flexible cutting-off machines in operation, but so far only the unbreakable nylon abrasive discs are used. The despatch department presented a gay appearance as the brightly polished bars and cylinders were embellished with highly decorative labels carrying the firm's trade mark.

This plant was very favourably commented upon by the investigation commission which went out shortly after the conclusion of hostilities. Since that time, great attention has been paid to the provision of amenities for the workmen. The canteen is quite the nicest so far seen by our representative. Most British canteens are somewhat garish, possibly on account of the steel furniture and general appearance of austerity. In contrast, the furniture of this canteen is well designed and of the traditional wooden construction; the walls are panelled and the whole appearance is, as it should be, of a restful character. There are three tables reserved, not necessarily for the staff, but for those in their town clothes. Should the director enter in his white works coat then he no longer sits in the "reserved seats." About half the working staff use the canteen facilities which is understandable as the firm has built a number of houses and flats on sites adjoining the foundry and more are in process of construction. The first-aid department, under the supervision of the works doctor, is modern and well equipped, whilst the washing and bathing facilities compare with the best we have in this country. Men having the dirty jobs have a pair of air-conditioned wardrobes. Throughout the whole works cleanliness and good housekeeping are everywhere apparent and this must indeed be reckoned amongst the best European bronze foundries.

Notes from the Branches

London—Southampton Section

The Southampton section of the London branch of the Institute of British Foundrymen held their first meeting at the Technical College, St. Mary Street, Southampton, on September 17, when, following the presidential address, films were shown on foundry practice in America.

The meeting was attended by over 80 foundrymen and executives from Southampton, Portsmouth, Bournemouth and other areas; as well as representatives from the local Education Committee and British Railways.

Dr. O. P. Einerl, F.I.M., section secretary, welcomed those present, and introduced Mr. W. G. Mochrie, honorary secretary of the London branch. The president of the section, Mr. V. W. Meager, in his presidential address, emphasized the necessity for bringing to the notice of parents, and boys who were about to leave school, the major part which the foundry played in all industries, and the prospects ahead for any youth who was prepared to study and acquire the very high standard of technical knowledge required in this industry.

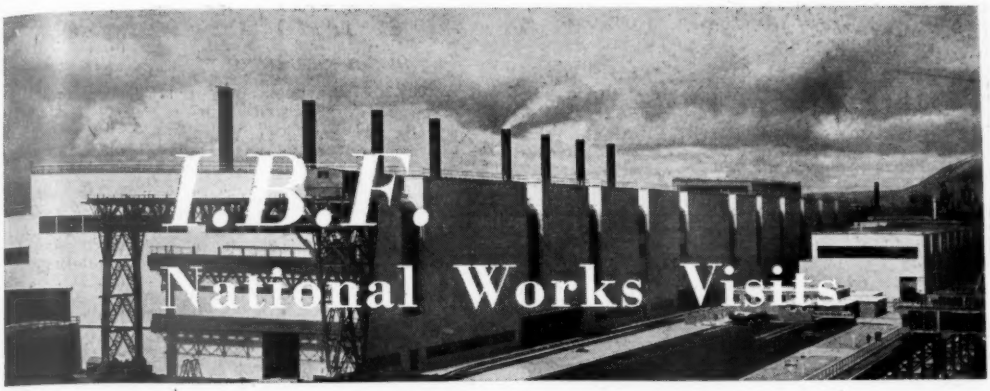
After the film display the president called upon those present to express their views on what they had seen. Quite a number did so, and some very interesting points were made, making comparisons with American methods.

Controlled Prices Exceeded

Transactions in steel and iron scrap at prices above the controlled maximum led to fines of £50 last month on two West Bromwich firms described in court as "old friends and neighbours." One was a foundry and the other their suppliers, and both pleaded guilty to 12 summonses relating to offences committed in August last year when a total of just over 100 tons of scrap was sold to the foundry. In respect of 10 of the summonses, the controlled maximum price of the scrap was 86s. 7d. per ton, but the supplies had been sold at 95s. per ton. The offences were discovered by a Ministry of Supply inspector who examined invoices covering the purchases of the scrap. Later in the month the controlled price rose to 126s. 7d., but two consignments passed between the firms at 135s. per ton. The total excess profit made by the suppliers was a little over £43. Prosecuting for the Ministry of Supply, Mr. C. H. Lewis said: "We do not regard it as a very serious or deliberate black-market offence, but I do think the defendants have been a little casual." A suggestion was also made that they were not familiar with prices. The Chairman of the Bench (Major John Lees) said both firms were of highest repute and the Bench felt there was misunderstanding with regard to the regulations about selling.

ABOUT 800 EMPLOYEES of Newman, Hender & Company, Limited, and their subsidiary NH Engineering, Limited, Trowbridge, visited London on September 20 for their annual works' outing.

HUNGARIAN engineers have recently received awards for their researches into Hungarian bentonite resources. Hungarian bentonite was used in foundry work for the first time in 1941. In 1949 a bentonite research committee was set up with the aim of finding out how best to exploit this product, and, as a result, the use of bentonite has spread to 42 different industries, and a surplus for export is now available.



For the third year running, the Institute of British Foundrymen has arranged a series of works visits open to members from all over the country. This year, the Wales and Monmouth branch are the hosts, and the nine works in the district are to be visited on October 24. So that the intending participants, as well as other readers, will have some idea of the establishments to be seen, brief descriptions are recorded here.

STEEL COMPANY OF WALES*

The Steel Company of Wales was formed when four great companies engaged in the steel and tinplate industries pooled their resources and knowledge in order to make what is possibly the greatest single contribution to British industry to-day. For many years South Wales has been the home of British tinplate but even to-day 70 per cent. of the tinplate produced in Wales is made by the old pack-mill method, which though it calls for a high degree of skilled work, is slow and costly. Modern experience has proved beyond all doubt that the continuous strip-mill is superior not only in speed of production, but in uniformity and operational economy and long before the war it was obvious to all engaged in the industry that only the building of a wide continuous strip-mill in South Wales could really put the industry back on its feet and enable it to maintain its place in the competitive markets of the world.

It was considered that the task of reconstruction required was beyond the resources of any individual group and an amalgamation was therefore formed between four of the largest companies engaged in the industry. It was this amalgamation which led to the formation of the Steel Company of Wales. Under the Chairmanship of Mr. E. H. Lever, the four founder companies, Guest Keen Baldwins, Richard Thomas and Baldwins, John Lysaght, and the Llanelly Associated Tinplate Companies, pooled certain of their resources calculated at a value of more than ten million pounds, including a steelworks at Port Talbot and Margam, 18 tinplate works in west Wales, and a sheet works at Newport (Mon).

* Readers wishing to have a complete record of the construction and production operation of the Steel Company of Wales are referred to special issues of our sister journal, "Iron and Coal Trades Review," in January, 1952, and on October 1, 1952.

Construction Plan

The plan was to reconstruct and enlarge the blast furnaces, coke ovens and coal- and ore-handling plant at the Margam steelworks, in order to produce the greater proportion of pig-iron required, and to erect adjacent to the Margam works, a new 80-in. continuous strip-mill, together with a melting shop and ancilliary plant, making one integrated works which would, when completed, extend for 4½ miles, and produce about 1½ million tons of steel ingots per year. (The illustration at the head of this article shows the melting shops which form but a part of this huge plant.) As an integral part of the scheme there were to be two cold-reduction mills and a modern tinplate plant. One of these cold mills was placed alongside the continuous mill at Margam, while the other, together with the tinplate plant, was located at Trostre, near Llanelly. Work on the reconstruction of the Margam Works and for the erection of the new Abbey Works commenced on April 29, 1947, and since that time almost every form of modern civil engineering has been carried out. Now, all the main items of plant are in operation and the works, which employs about 8,500 people, is helping to maintain the reputation of Welsh sheet steel and tinplate all over the world.

SAUNDERS VALVE COMPANY, LIMITED

The Cwmbran works of the Saunders Valve Company, Limited, concentrates on the manufacture of their well-known diaphragm valve and occupies a site of nine acres of which an area of 75,000 sq. ft. has been developed. The factory commenced production in 1938, was extended in 1948, and a further extension is due to start which will add another 15,000 sq. ft. of covered space. The works is somewhat unusual in that three industries are housed under one roof, *viz.*, foundry, machine-shop and rubber manufacturing.

FIG. 1.—*General View of the Saunders Valve Foundry, showing Gravity Roller Track for Box Storage with a Rotary Melting Furnace in the Background.*

FIG. 2.—*Separately-housed Platform, Dust-extractor, Knock-out, and Sand Plant at Saunders Valve Foundry. Note the Side Exhaust at the Knock-out and the Chutes for disposing of Castings and Runners.*

The foundry section, comprising patternshop, coreshop, foundry, fettling-shop and annealing plant, employs over 100 men and women and produces grey-iron, blackheart malleable iron, gunmetal and aluminium pressure-tight valve castings ranging from ½ lb. to 4 cwt. In addition, castings are made for the Safran pump which is manufactured by the Company's subsidiary concern (Franks & Saunders) at the Wolverhampton Works. The patternshop is well equipped for the production of wood and metal patterns. The coreshop, using 20 tons of silica sand per week and chiefly employing female labour, is serviced with a gas-fired vertical sand drier, a core-sand mixer fed by a sand elevator, horizontal, vertical and bench type core-blowing machines and hand coremaking benches. Coremakers are located on both sides of a steel-band conveyor which feeds the two Acme vertical gas-fired continuous ovens.

Ironfoundry

The ferrous foundry, using synthetic sand, produces moulds made on four MacNab straight-draw machines and one large Wallwork pin-lift machine, all fed from overhead sand-hoppers. Gravity roller conveyors are used for taking moulds away from the machines for continuous casting in grey iron, the same tracks being used as storage facilities for batch melting of rotary furnace (Fig. 1). Grey iron is provided by a cupola and a 1-ton capacity oil-fired Stein Rotary Furnace is used for malleable iron. Poured moulds are conveyed by a slat conveyor to a separate and specially-constructed bay which houses a knock-out station (Fig. 2), Wheelabrator and mechanized sand-conditioning plant incorporating magnetic separator, rotary screen,

FIG. 3.—*Section of the Neat, Well-arranged Fettling-shop at the Saunders Valve Company.*

storage hoppers and continuous mill. Castings inspection is located between the Wheelabrator and the fettling-shop shown in Fig. 3. Annealing is carried out in a solid-fuel-fired "Beehive"-type oven which is mechanically loaded and unloaded.

The machine-shop, which deals with the whole of the foundry output, is equipped with special-purpose machines designed for dealing with valve components in addition to the more conventional centre lathes, radial drills, milling machines, capstan lathes, etc. After machining, all castings are treated with a rust-preventive process before passing to the assembly section. Each of the thousands of valves assembled daily is subjected to a searching porosity and operating test before final inspection and delivery to the packing and despatch bay. Approximately 60 per cent. of the valves are for export to all parts of the world, except those behind the "iron curtain."

The rubber manufacturing department is equipped with the most modern mixing and milling plant with steam-heated moulding presses serviced by oil-operated hydraulic pumps. To cope with the varying service demands made on the valve more than 20 grades of rubber are produced in both natural and synthetic types. The manufacture of the Saunders Aero cock which is fitted to 90 per cent. of British aircraft now in operation has recently been transferred to the Hereford works of the company.

JOHN WILLIAMS & SONS (CARDIFF), LIMITED

John Williams & Sons (Cardiff), Limited, have been trading for 108 years and commenced when the great-grandfather of the present managing directors opened an ironmonger's shop and smithy in the centre of the city. The iron foundry is situated on the dock area and has been operating since 1864. At first, the main type of casting produced was for local ship repairers and steelworks, although contracts were secured for such castings as bollards, which were sent to contractors in many part of the world. To-day the foundry employs 120 people out of the total of over 600 in the whole of the company, and all the premises are now in the dock area, the ironmonger's shop having been closed in 1917. In addition to the foundry, the company are well known as iron and steel stockholders, specializing particularly in the plates and sections for the ship-repairing industry. In normal times, stock of about 4,000 tons is held. In 1889, the company made their first metal windows, and to-day the window factory has an annual output of windows and steel partitions of about 1,600 tons, including about 100,000 windows per year. To cater for the growing demand for galvanized windows, a new hot-dip galvanizing plant was laid down in 1947 and handles also a wide range of other articles. The plant is

FIG. 4.—*One of the Mould Assembly and Casting Lines at the Foundry of John Williams & Sons (Cardiff), Limited. Note the use of quick-acting Moulding-box Clamps and Loose-pins with Handles attached.*

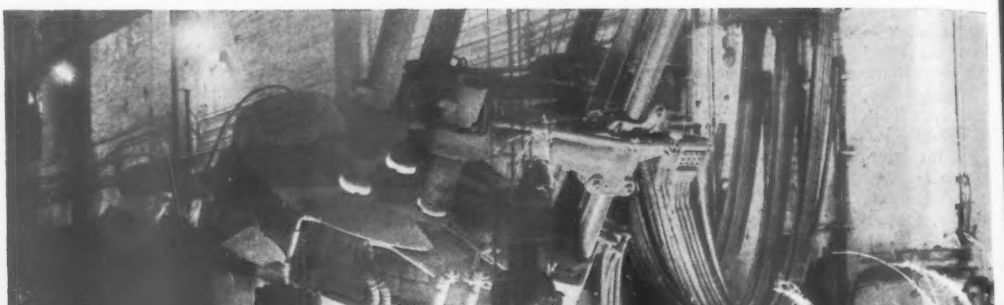


FIG. 5.—*Tapping Steel from the Electric Furnace at the Works of Glanmôr Foundry Company, Limited. Castings up to 8½ tons, finished weight, are currently produced.*

fired by oil and the temperature of the metal and the flues is automatically controlled. For many years the company has also run a constructional department, which to-day specializes in welded plate fabrications, as well as normal structural steelwork.

Foundry

The foundry has for the last 20 years specialized in alloy and high-duty cast irons, such as Ni-Resist, Ni-Hard, Nicrosilal and high-tensile iron, while the normal production of grey iron is a high-quality low-phosphorus inoculated engineering iron. The site of the foundry is much the same as nearly 90 years ago, but it has been adapted in recent years to cater for small batch repetition and small quantity production in all these metals. Melting units comprise two 28-in. dia. cupolas working on alternate days, and to give extra flexibility these work in conjunction with a 10-cwt. rocking-arc furnace for duplexing as well as melting from cold.

The firm is a member of the Technically Controlled Castings Group, and great care is taken in the control of the metals produced and careful inspection of castings before despatch is a particular feature. A laboratory for chemical analysis is attached to the foundry, but the patternshop is situated on another site where the constructional department also has a stockyard and where wooden surrounds are made for the metal-window department. The illustration, Fig. 4, shows part of one of the mechanical moulding and casting lines.

GLANMOR FOUNDRY COMPANY, LIMITED

Glanmôr Foundry Company, Limited, was formed in 1890 to take over the business which was originally known as "Powells" foundry. The foundry was completely rebuilt and re-equipped with a view to undertaking the complete manufacture of two-high sheet and tinplate mills, including all the iron and steel castings necessary and also the chilled rolls. The company specialized in the manufacture of heavy iron and steel castings and the heaviest steel casting produced weighed over 26 tons finished weight. The largest iron casting was a 32-ft. dia. flywheel produced for John Lysaght & Company, Limited, Newport. This wheel was made in seven pieces and, when completed, had a total weight of 168 tons. The foundry was responsible for making complete mills, not only for this country, but for several foreign countries as well, and has always specialized in the manufacture of chilled hot and cold rolls for both sheet and tinplate works. The works is fully equipped with its own patternshop and machine shop, both capable of handling the largest castings produced.

In 1939, Glanmôr Foundry formed an association

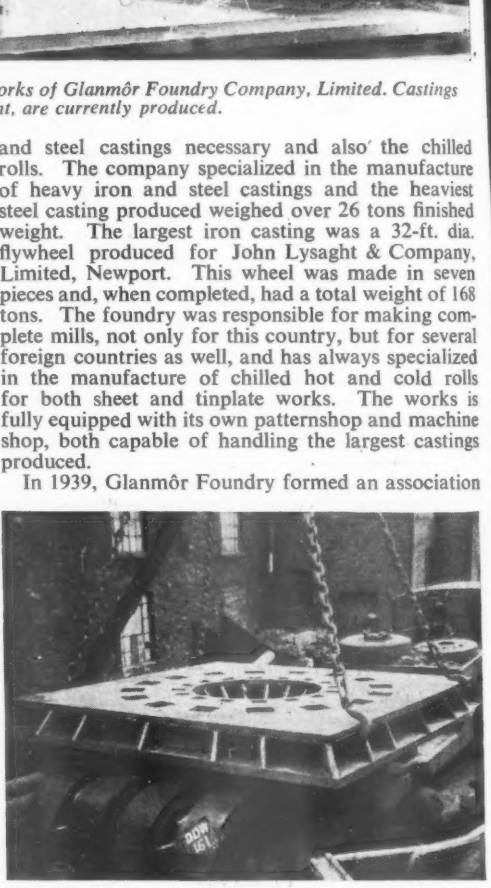


FIG. 6.—*Iron Base-plate Casting, weighing 18 tons, Loaded for Despatch from the Glanmôr Foundry, Company, Limited.*

with Thomas & Clement, Limited, of Llanelly, and the smaller iron castings and all fabricated work are now carried out by this concern. During the last war, extensions were made to the foundry and a modern electric furnace (Fig. 5) was installed, capable of producing steel for castings up to 8½ tons in weight. At the present time, the main production of the foundry is steel castings and the only iron castings produced are those which are too heavy for Thomas & Clement, Limited; Fig. 6 shows a typical example of these.

LANDORE INGOT-MOULD FOUNDRY*

The production of ingot moulds at the Landore (Swansea) foundry of Richard Thomas & Baldwins Limited began early in 1951. Facilities are now available for the manufacture of all types of ingot moulds up to 30 tons, together with bottom-plates and slag ladles, for the Company's various works and those of the Steel Company of Wales, Limited. Between 160 and 170 men are employed in these operations.

The main foundry building at Landore is 180 ft. wide by 560 ft. long. It comprises—apart from offices situated at one end—the cupola bay and storage bunkers, the ingot-mould and slag-ladle production floor with accompanying drying stoves situated parallel and alongside the casting floor, as well as knock-out grids, and a fettling department at the western end. Two moulding pits, situated at either end of the casting floor, are each served by three Sandslinger machines. In addition, a pattern-shop and joiners' shops are situated just off the main foundry building.

Melting and Moulding Facilities

Melting and foundry facilities are available for the production of approximately 1,000 tons of metal castings each week. Adequate lifting capacity is available for the charging of cupolas, the transfer of hot metal, and the transport of ingot moulds. All finished moulds are finally assembled, ready for casting, on the floor of the foundry and casting pits have thus been avoided. The foundry's three large cupolas are of the conventional design and each of 15 tons per hour capacity. Their height is 21 ft. 11 in. from taphole to charging floor, and internal diameter is 5 ft. 11 in. The furnaces, which are worked one each day in rotation melt a hematite-base iron. Four Keith Blackman high-pressure fans, with a capacity of 1,000 cub. ft. per min., supply blast at pressure of 21 in. w.g. These fans are installed on their own floor, approximately 15 ft. above the tapping floor. They are situated centrally between the three cupolas and feed into a common main. Limestone and coke for the cupolas are held in an adjacent stock bay and are replenished direct from rail wagons. Pig-iron comes from South Wales, the West Coast, Holland and Germany, with additional metal from scrap moulds.

One of the major features of the Landore foundry is the use made of Sandslingers for the ramming of moulds. No pneumatic or hand ramming is carried out in any form, except for the top plates and auxiliary items required for final moulds. By this means a very uniform sand mould is produced and after ordinary drying it is immediately ready for casting.

(To be continued)

* Production methods at this foundry were recently described fully in a Paper by Mr. J. Raymond Jones presented to the Buxton Conference of the Institute of British Foundrymen and printed in the JOURNAL July 24 and 31, 1952.

Personal

MR. EDWARD PLAYER, managing director of Birmid Industries, Limited, has left for a six-weeks visit to America.

SIR WILFRID AYRE, chairman of the Burntisland Shipbuilding Company, Limited, has been appointed a director of the Newfoundland-Great Lakes Steamships, Limited.

MR. ASHLEY RICHARD, managing director of Rovearc, Limited, engineers, of Benacarr (Yorks), was injured by flying fragments when a grindstone broke up as it was in use at the company's works.

LT.-COL. L. F. R. FELL, technical sales manager of Rolls-Royce, Limited, Derby, and inventor of the Fell Diesel locomotive, has received the Frederick Harvey Trevithick award from the Institution of Locomotive Engineers.

MONSANTO CHEMICALS, LIMITED, announce that Mr. W. Morgan Thompson is appointed deputy general manager of sales with effect from October 1. Mr. Morgan Thompson joined the company in 1933, was appointed manager of the fine chemicals section of the sales division in 1945 and sales controller in 1950.

MR. A. LLOYD recently retired from the post of cashier to the Lilleshall Company, Limited, and the Lilleshall Iron & Steel Company, Limited, after completing 45 yrs. service. To mark the occasion Mr. A. Loxley, general manager, presented him with a gold watch on behalf of the officials and staff at the company's head office.

MR. S. C. TYRRELL, F.C.W.A., F.I.I.A., chief accountant and local Board director of Newton Chambers & Company, Limited, the Yorkshire ironfounders, engineers and chemical manufacturers, and president of the Institute of Cost and Works Accountants, has received the Gold Medal of Honour, at its Paris Congress this week, of the Industrial Society of the Province de l'Est.

MR. W. STEVENSON, chief metallurgist of Dorman, Long & Company, Limited, presided at the first annual meeting at Middlesbrough recently of the newly-formed North-East Metallurgical Society. MR. J. W. GAILER, head of the metallurgical and pure science department of Constantine College, Middlesbrough, is the honorary secretary and treasurer of the society, which has 120 members.

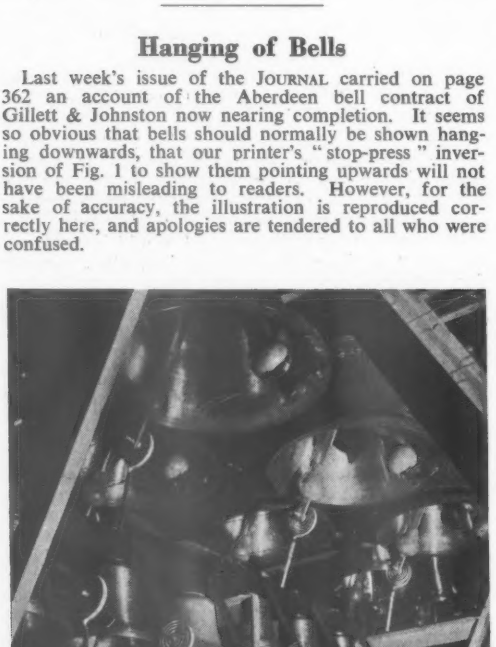
MR. ROBERT J. PAINTER has been elected executive secretary of the American Society for Testing Materials, with MR. RAYMOND E. HESS as associate executive secretary and editor-in-chief. These appointments were made following a report of a special committee which had been appointed to recommend a successor to the late Mr. C. L. Warwick, who was for many years executive secretary of the society, and who died suddenly on April 23.

Film Review

White Lead Paint.—Two films, "White Lead" and "Magnet—A White Lead Paint," sponsored by Associated Lead Manufacturers, Limited, were shown to the technical press at the Hammer Theatre, Wardour Street, London, W., on September 23. The first depicts the mining of lead ore and the conversion of the purified pig lead into white lead, first by the old Chamber process, and then by the modern Octagon process. The film ends with views of notable buildings on which white lead paint has been used, the most important being the Brighton Pavilion; a section of the paintwork, removed in 1952 and photographed under the microscope, shows 21 coatings, applied since 1800, still bonded together and forming a composite coating of great protective value. The second film, which is in colour, deals with the manufacture of a white-lead base, hard-gloss, paint at the Associated Lead factory at Millwall. The two films are complementary and are intended to be shown together to paint specifiers and users, though it is suggested that the first may be of interest on its own to technical schools, apprentice training schemes, and for shows of a technical nature.

Hanging of Bells

Last week's issue of the JOURNAL carried on page 362 an account of the Aberdeen bell contract of Gillett & Johnston now nearing completion. It seems so obvious that bells should normally be shown hanging downwards, that our printer's "stop-press" inversion of Fig. 1 to show them pointing upwards will not have been misleading to readers. However, for the sake of accuracy, the illustration is reproduced correctly here, and apologies are tendered to all who were confused.



By Courtesy Tin Research Institute.

Obituary

MR. JOHN J. MACGREGOR, of Glasgow, who has died at the age of 81, retired in 1942 from the North British Locomotive Company, Glasgow, after completing 35 years as foreman in the frame shop, where he succeeded his father. He had sailed as a marine engineer and worked in the gold mines of South Africa.

MR. ROBERT HUDSON, a former Provost of Kirkintilloch, who died on September 24 at his home, at the age of 73, for the greater part of his life was actively associated with the Lion Foundry Company, Limited, Kirkintilloch, and for about 20 yrs. was a director of the firm. He retired some months ago from office.

MR. C. J. EVANS, of Handsworth, Birmingham, who has died at the age of 75, was well known in commercial circles. He was employed by Samuel Smith & Company, of the Beehive Foundry, Smethwick, and for a time by the Carron Company, of Falkirk. He returned to Smith's, Smethwick, to become Midland representative, a post which he held for 25 years, managing the firm's Birmingham office until it was closed.

MR. C. J. EVANS, of Handsworth, Birmingham, who has died at the age of 75, was well known in commercial circles. He was employed by Samuel Smith & Company, of the Beehive Foundry, Smethwick, and for a time by the Carron Company, of Falkirk. He returned to Smith's, Smethwick, to become Midland representative, a post which he held for 25 years, managing the firm's Birmingham office until it was closed.

THE DEATH occurred on September 25 of MR. THOMAS COSSAR, of West Park, Harrogate, inventor of the Cossar printing press. At the beginning of this century Mr. Cossar carried out experiments while in Glasgow to convert an Otley-made printing press so as to be capable of printing and folding a newspaper in two operations. As Payne & Sons, of Otley, agreed to take up its manufacture, Mr. Cossar went there to supervise the building of the first machine. He stayed in Otley and eventually joined the company as executive. The first complete machine was shipped to New Zealand in 1903. Mr. Cossar was prominently associated with the Otley printing industry during the whole half century.

Joint Italian Foundry Conference

The second *Assofond* foundry conference and the sixth *Centro Fonderia* of A.I.M. foundry conference will take place at Rapallo from October 3 to 6. Papers dealing with important economic, social, technical, scientific, cultural problems and problems of organization are to be read and discussed at the conference. Amongst the lecturers are Mr. W. W. Braidwood, of the Mond Nickel Company, Limited, and Mr. Nicolas, of the *Centre Technique* of Paris.

Board of Trade Directory

The Board of Trade Journal has published as a supplement a "Board of Trade Directory." A complete list of the various sections of the Board is included, with their functions, addresses, and telephone numbers; there is a comprehensive alphabetical index of "subjects," giving the sections responsible for each; and there is a detailed list of the various industries for which the Board of Trade, the Ministry of Supply, and other Ministries, are the "production departments" (*i.e.* for which they have primary responsibility in such matters as allocation of materials). The directory, containing much hitherto unpublished material, should prove of considerable assistance to all who have frequent dealings with Government departments on commercial matters. Copies may be obtained from H.M. Stationery Office, P.O. Box 569, London, S.E.1, price 9d. (10½d. including postage).

Some Effects of Magnesium on the Formation of Graphite in a Solidifying Cast Iron*

By I. C. H. Hughes, B.Sc., A.I.M.

(*Continued from page* 356)

Cooling curves were constructed which embodied the chief features of the experimental curves, one for flake-graphite irons (one curve to illustrate both inoculated and non-inoculated types), one for magnesium-containing inoculated irons, and one for magnesium-containing non-inoculated irons. These are illustrated in Fig. 7. Ten points were selected on each curve from which samples were to be quenched during solidification. The most important of these are indicated in Fig. 7 and the microstructures of the quenched samples of each type of iron corresponding to the points in Fig. 7 are illustrated in Figs. 8 to 11.

Further Melts

Melts were made of 5 to 10 kg. (11 to 22 lb.) in the same way as those earlier described. Instead, however, of using 100- to 150-gm. samples, a smaller sample crucible was used, holding between 50 and 100 gm. of iron. A suspension cradle was attached to the tube (D) (Fig. 3) by a thin piece of Brightray wire. After suitably preparing the melt, a sample was taken in the same way as before. Instead, however, of raising the sample into the top furnace for cooling, it was raised to a point near to the top of the furnace (A) and the trap (G) was opened. Under these conditions, its cooling rate was similar to that of the previously-determined curves. The temperature of each sample was followed on the potentiometer and when the predetermined temperature was reached the Brightray wire was cut, releasing the crucible, which fell into the water-bath below the apparatus, where it was agitated violently until cold. The sample carried the thermocouple sheath with it, but the couple slid out easily and was left suspended.

The results were checked by performing a number of additional experiments at intermediate temperatures; consequently about 20 samples were obtained for each curve. The samples were sectioned and examined microscopically over the whole surface exposed, which always was orientated to include the thermocouple sheath. Solidification before quenching was usually more advanced near to the top surface of any particular specimen, due to the temperature gradient at the air/metal surface, but otherwise the samples, with one or two exceptions, which were disregarded, showed quite uniform appearances. In preparing the sample quenched from 1,350 deg. C. a different procedure was used. To obtain a very-rapidly-quenched sample of the liquid iron this was poured from the melting crucible directly into water, so as to obtain small pieces of less than $\frac{1}{16}$ in. thickness. The resulting samples were mounted in bakelite, polished, and examined over as great a cross-sectional area as possible.

Figs. 8 to 11 illustrate selected microstructures of the four series of samples investigated. Each sample is identified by a letter corresponding to the time of quenching, as illustrated in Fig. 7. Some of the samples were very lightly etched, in order to reveal their matrix structures more clearly. Since the microstructures of most samples consisted of mixtures of austenite, iron-carbide, martensite and graphite, it was difficult to obtain an etch which revealed all the details clearly. When etching was performed, a saturated solution of picric acid in alcohol was used. These results will be considered in detail in the order considered to be most logical.

OBSERVATIONS

Inoculated Magnesium-free Irons

The quenched samples of inoculated magnesium-free irons are illustrated in Figs. 8 (*a*) to 8 (*f*). Only from the sample poured into water from 1,350 deg. C. (Fig. 8 (*a*)) was graphite substantially absent, although even this sample, when viewed at a high magnification, showed some very small graphite particles having diameters less than 0.004 mm., with spheroidal and irregular nodular outlines. In samples quenched from lower temperatures, the liquid remaining at the time of quenching transformed, during quenching, into a mixture of very fine graphite and an acicular iron-carbide/austenite structure. During cooling to room

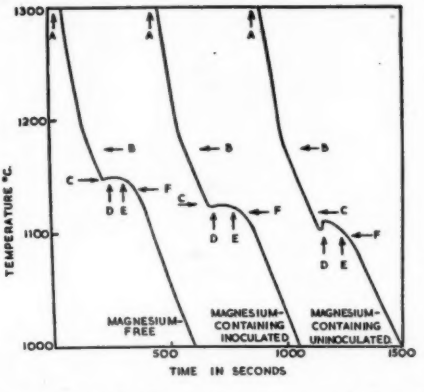


FIG. 7.—"*Standard*" *Cooling Curves of Cast Irons showing Temperatures from which the Samples Illustrated in Figs* 8 *to* 11 *were Quenched.*

* Paper presented to the Buxton Conference of the Institute of British Foundrymen. The Author is attached to the Mond Nickel Company, Limited, Birmingham.

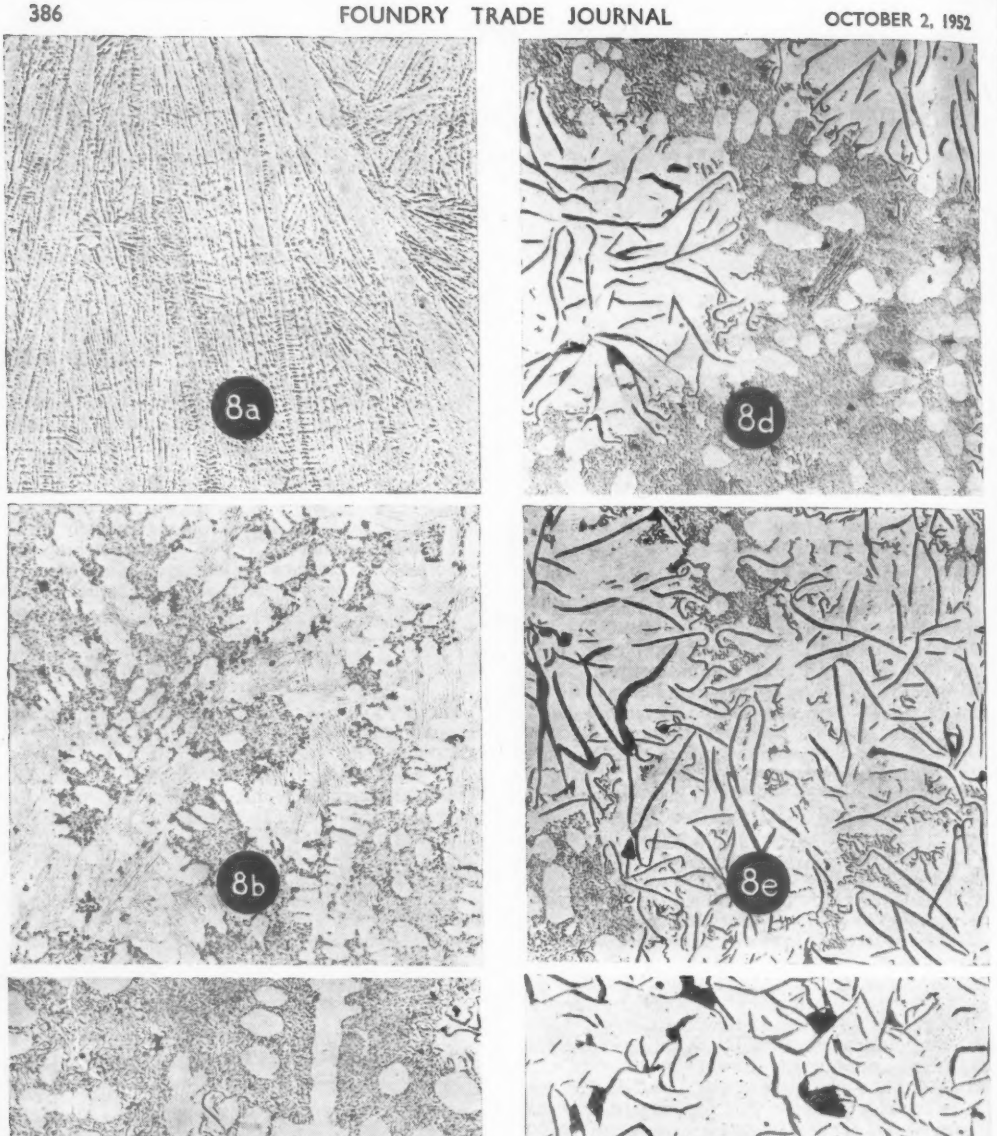


FIG. 8.—*Progress of Solidification of Inoculated Magnesium-free Iron.* ×100. *Samples a to f quenched from temperatures as follow:—*
a—1,350 deg. C. *b*—1,180 deg. C. *c*—1,150 deg. C. *d*—1,150 deg. C. *e*—1,145 deg. C. *f*—1,140 deg. C.

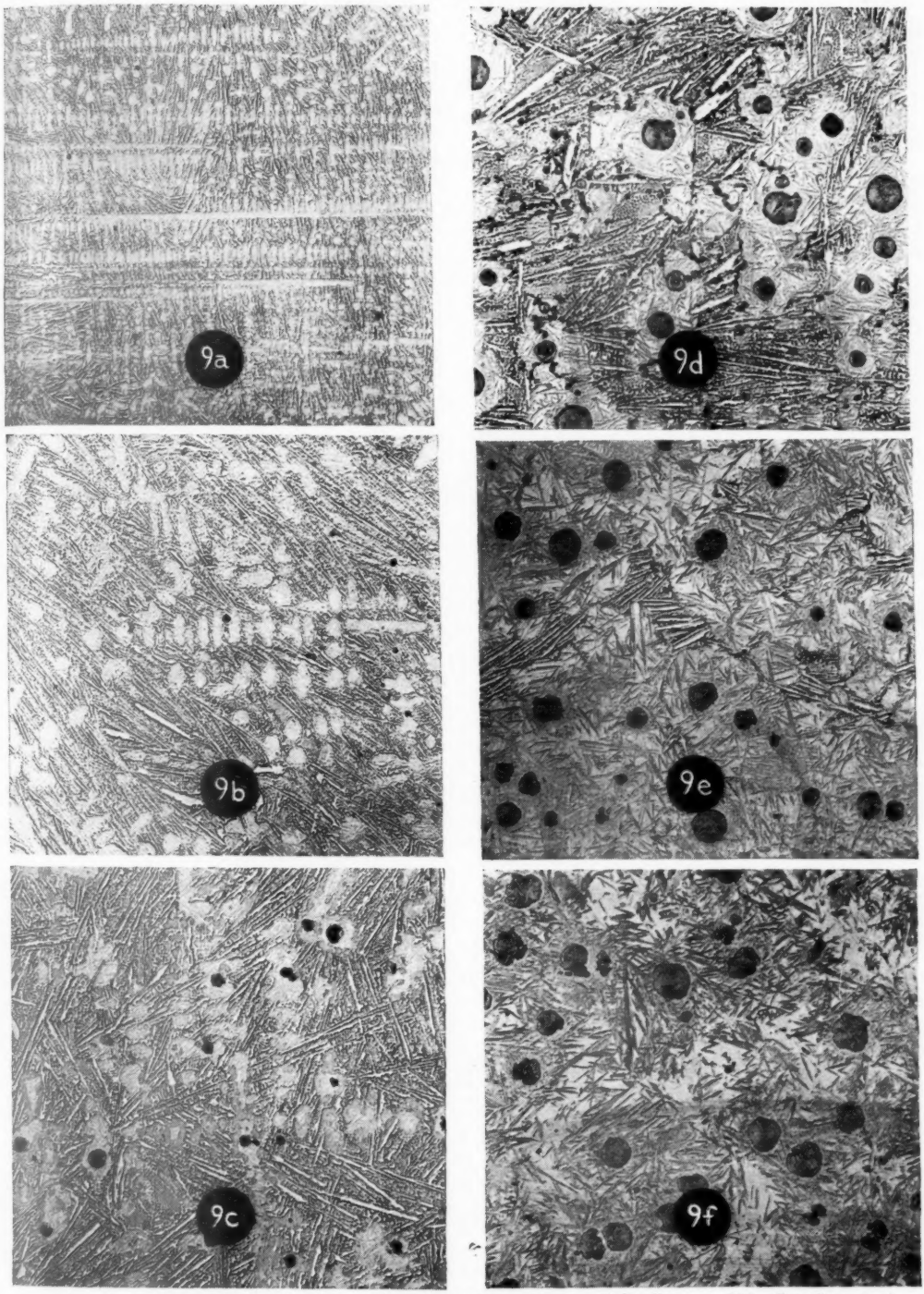


FIG. 9.—*Progress of Solidification of Inoculated Magnesium-containing Iron.* ×100. *Samples a to f quenched from temperatures as follow:—*
a—1,350 deg. C. *b*—1,170 deg. C. *c*—1,125 deg. C. *d*—1,124 deg. C. *e*—1,120 deg. C. *f*—1,115 deg. C.

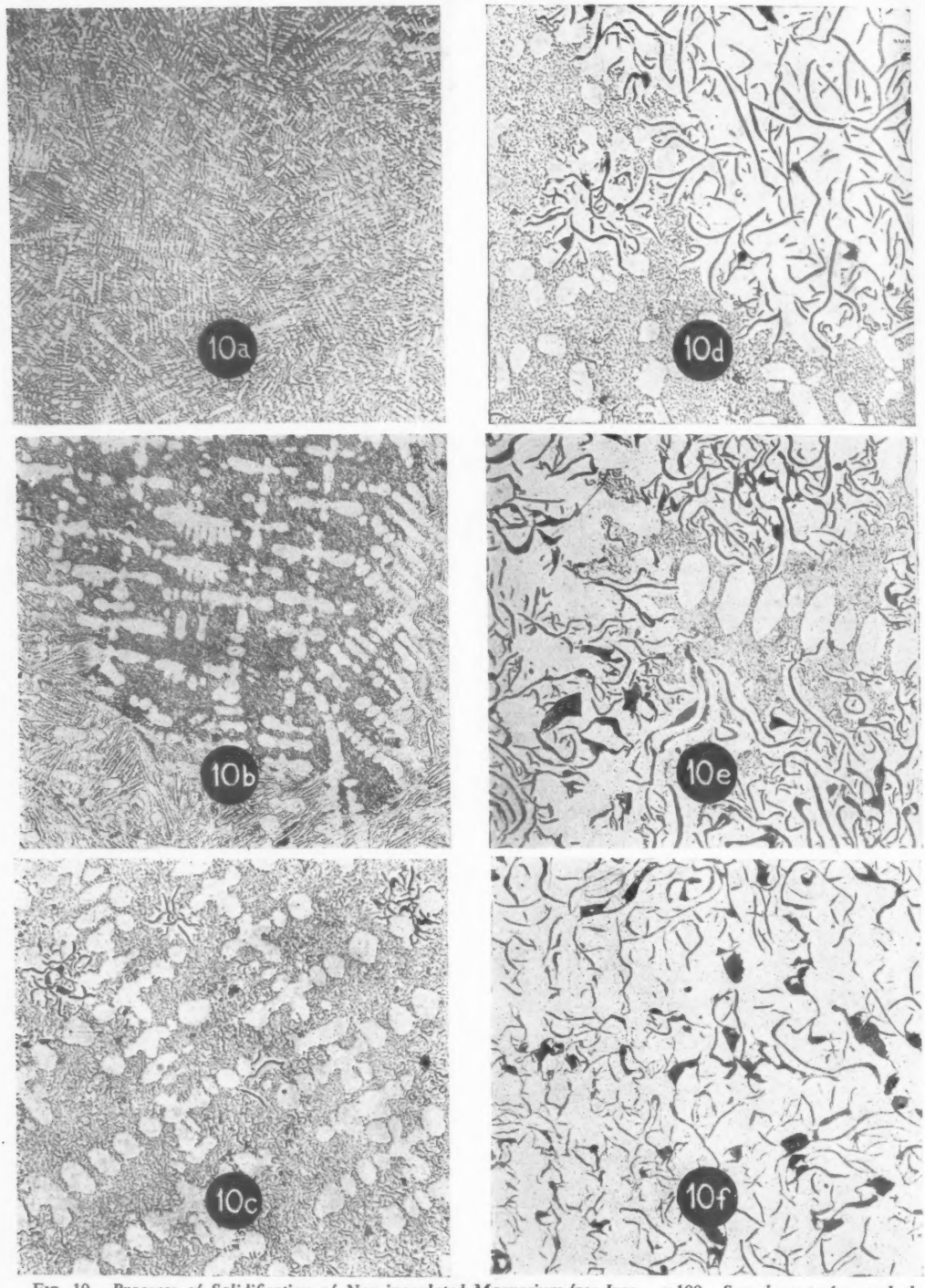


FIG. 10.—*Progress of Solidification of Non-inoculated Magnesium-free Iron.* ×100. *Samples a to f quenched from temperatures as follow:—*

a—1,350 deg. C. *b*—1,180 deg. C. *c*—1,159 deg. C. *d*—1,150 deg. C. *e*—1,145 deg. C. *f*—1,140 deg. C.

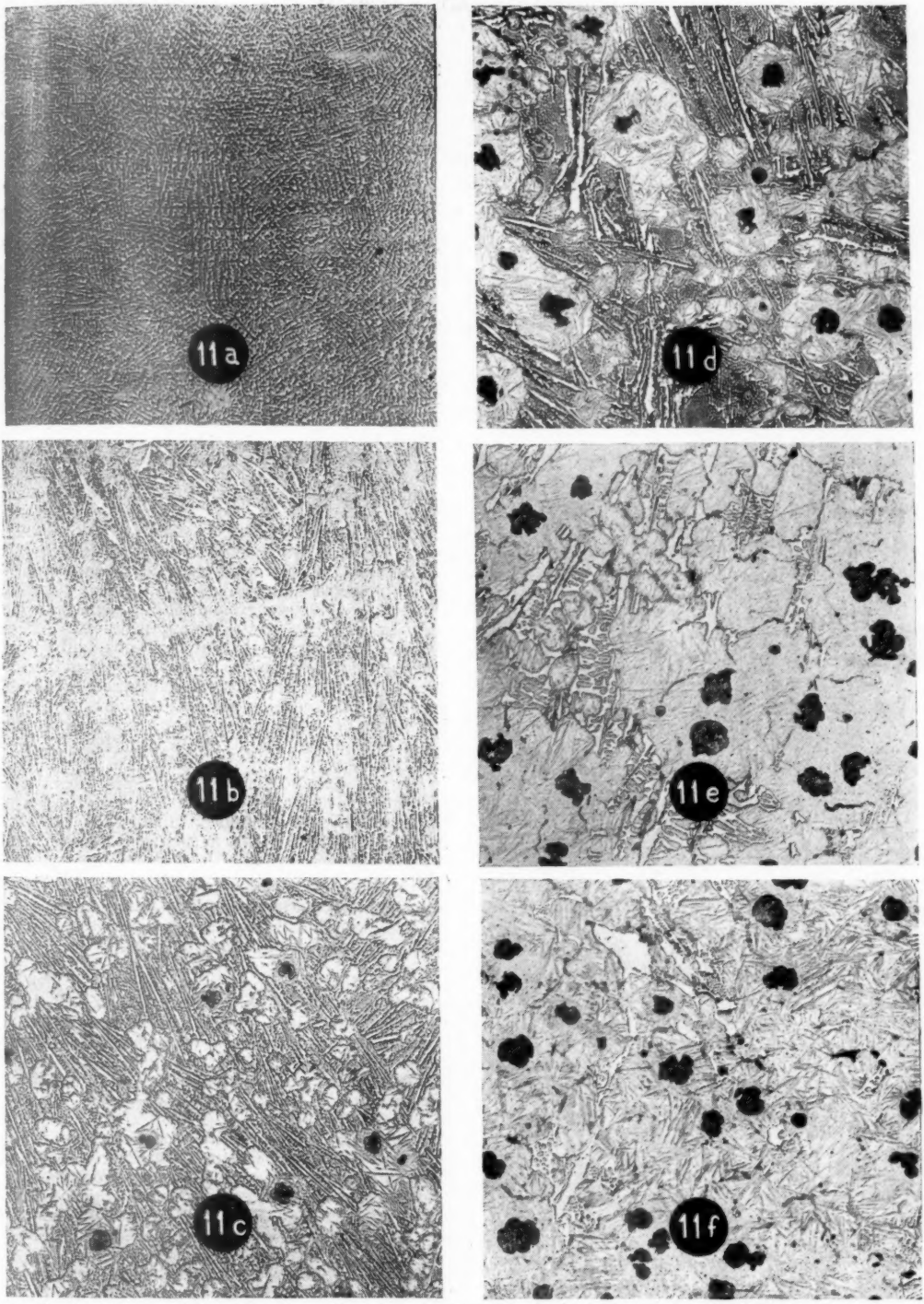


FIG. 11.—*Progress of Solidification of Non-inoculated Magnesium-containing Iron* (×100). *Samples a to f quenched from temperatures as follow:—*

a—1,350 deg. C. *b*—1,170 deg. C. *c*—1,115 deg. C. *d*—1,110 deg. C. *e*—1,105 deg. C. *f*—1,100 deg. C.

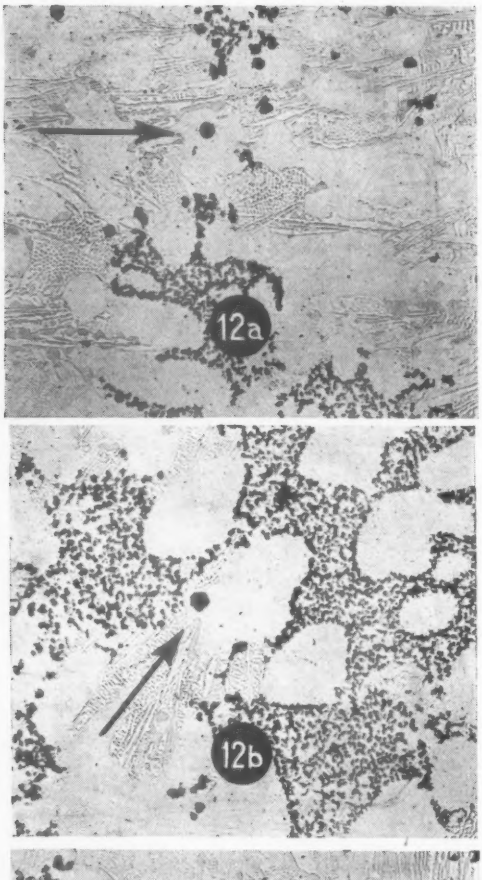


FIG. 12.—*Photomicrographs of Inoculated Magnesium-free Iron Sample b, quenched from* 1,180 *deg. C, selected to show Graphite Spheriods (a) within the Primary Austenite (b) at the Austenite-liquid Interface, and (c) in the Liquid.* (× 350.)

temperature, the austenite had transformed to martensite.

Specimen B (Fig. 8 (*b*)), quenched from 1,180 deg. C., showed the beginning of growth of austenite dendrites, and specimen C (Fig. 8 (*c*)), quenched from 1,150 deg. C., showed clearly the presence of coarse graphite flakes which were radiating from centres of crystallization of the eutectic liquid. These centres were present generally close to the austenite dendrites and were clearly in a very early stage of development at the time of quenching, since the flakes in them are not fully developed (compare Fig. 6 (*a*)) and probably grew mostly during quenching. The eutectic cells grew subsequently, as shown in Figs. 8 (*d*), 8 (*e*) and 8 (*f*) to replace completely the remaining liquid. In these cells, the graphite flakes grew edgewise from the centre of crystallization, with their leading edges in contact with the liquid, while the austenite grew, apparently with a lower linear velocity, filling in the space between the flakes, in a form resembling the webs of a duck's foot. Under the cooling conditions employed, the eutectic reaction was complete after a 10 deg. C. fall in temperature from the arrest, and the individual centres of crystallization were then almost indistinguishable (see Fig. 8 (*f*)).

Examination of the sample B at higher magnification revealed the presence of a number of small, perfect, graphite spheroids in the region of the acicular austenite/iron-carbide constituent. These were found to occupy various positions, both in the solid austenite dendrites, at the solid/liquid interface, and in the liquid. Examples of these spheroids are illustrated in Figs. 12 (*a*), 12 (*b*), and 12 (*c*). The most favoured position appeared to be at the liquid/solid interface as shown in Fig. 12 (*b*). Occasional very small spheroids were also visible in samples A and C (in the latter sample these were only very occasional); they were almost always in the liquid or at the liquid/solid interface. It was, however, observed that a greater number were often present in sample A near to the surface, where quenching had been most drastic.

Inoculated Magnesium-containing Irons

The microstructures of the quenched samples of inoculated magnesium-containing irons are illustrated in Figs. 8 (*a*) to 9 (*f*). Sample A (Fig. 9 (*a*)), quenched into water from 1,350 deg. C., while being substantially free from graphite, did contain a small number of very small graphite spheroids, of the order of 0.002 mm. in diameter. These were nearly always at the interface between the fine dendrites (formed during quenching) and the liquid, but occasionally occupied other positions. Sample B (Fig. 9 (*b*)), quenched after the start of austenite precipitation, contained a greater number of larger graphite spheroids. Their positions were similar to those in sample A, but a very thin austenite envelope surrounded each one. The remaining liquid in this and subsequent samples transformed to a clearly-distinguishable acicular austenite/iron-carbide structure in which the austenite had transformed to martensite during cooling. Figs. 13 (*a*), 13 (*b*) and 13 (*c*) illustrate the appearance, at high magnification, of sample B, showing the various

positions in which graphite spheroids were found. Most of the spheroids, however, were clearly at the austenite/liquid interface as shown in Fig. 13 (*b*). Sample C (Fig. 9 (*c*)), quenched from 1,125 deg. C., showed the beginning of growth of the graphite spheroids and an envelope of austenite round each one was visible. The presence of this envelope made it difficult to distinguish with certainty the position at which the spheroids originated with respect to the austenite dendrites. A careful study suggested, however, that as in the preceding samples, they were formed close to the austenite dendrites in the liquid, and that in the instances where the spheroids appeared to be within the dendrites, it was because the rapidly-growing austenite envelope of each spheroid was indistinguishable from any neighbouring dendrite arms to which it became attached.

The progress of solidification, as shown by samples D, E and F, is illustrated in Figs. 9 (*d*) to 9 (*f*). The eutectic reaction resulted in a simultaneous deposition of austenite upon the envelopes round the spheroids, and diffusion of carbon to the spheroids, and unlike the graphite in the magnesium-free irons, the graphite contained to grow out of contact with the liquid. Solidification was substantially complete after a fall in temperature of 10 deg. C., the amount of liquid remaining in sample F at the time of quenching being so small as to be negligible, considering the experimental errors involved in temperature measurement. Thus, although the inoculated flake-graphite and spheroidal-graphite irons solidified in different ways, they both showed eutectic reactions which were complete within approximately the same temperature interval.

Non-inoculated Magnesium-free Irons

Figs. 10 (*a*) to 10 (*f*) illustrate the progress of solidification of the non-inoculated magnesium-free irons. In sample B (Fig. 10 (*b*)), quenched from 1,180 deg. C., the liquid transformed to a slightly higher proportion of acicular-carbide/austenite structure than was found in the corresponding inoculated iron. Furthermore, the graphitic regions were large and compact, and not interspersed with the carbide in the way seen in Fig. 8 (*b*). This suggests that, whereas in the inoculated iron the the formation of the fine graphite during quenching occurred in all parts of the specimen, its formation in the non-inoculated iron was centred in certain preferred regions. Although occasional very small graphite spheroids were found in the samples A, B and C, they were far fewer in number than those in the corresponding inoculated flake-graphite iron samples described previously. The number of eutectic cells in samples D, E and F appeared to be slightly fewer than in the corresponding inoculated-iron samples and the variety of sizes of flake graphite in each cell was greater, there being more small flakes which tended to outline the primary austenite dendrites. Sample C, quenched just at the beginning of the eutectic reaction, showed a very high number of crystallization centres, but these appeared to have developed to a lesser degree during quenching than those in the corresponding inoculated-iron sample (compare Fig. 8 (*c*)).

(*To be continued*)

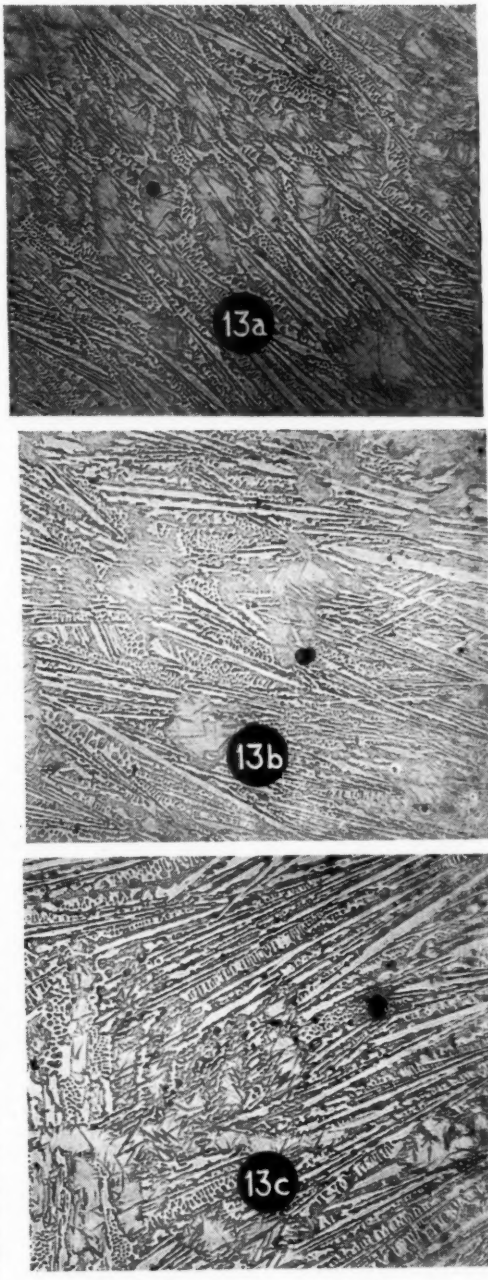


FIG. 13.—*Photomicrographs of Inoculated Magnesium-containing Iron Sample b, quenched from 1,750 deg. C, selected to show Graphite Spheroids (a) within the Primary Austenite, (b) at the Austenite-liquid Interface, and (c) in the Liquid.* (×350.)

Pig-iron and Steel Production

Statistical Summary of July Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarises activities during the previous six months; Table II gives production of steel ingots and castings in July; Table III, deliveries of finished steel; Table IV gives the production of pig-iron and ferro-alloys in July, and number of furnaces in blast. All figures in thousands of tons.

TABLE I.—*General Summary of Pig-iron and Steel Production.* (*Weekly average.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy). Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1950	249	174	197	185	197	9	313	241	997
1951	284	170	206	186	175	8	301	243	589
1952—February	306	187	222	197	177	20	313	236	525
March	306	184	221	202	181	23	320	253	551
April[1]	305	184	224	201	171	29	305	248	576
May	326	183	231	201	174	45	312	264	586
June	310	186	231	200	170	43	313	258	663
July[1]	306	194	233	202	150	38	274	—	772

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in July*, 1952.

District.	Open-hearth Acid.	Open-hearth Basic.	Bessemer.	Electric.	All other.	Total. Ingots.	Total. Castings.	Total ingots and castings.
Derby., Leics., Notts., Northants and Essex ..	—	3.1	11.0 (basic)	1.6	0.2	15.1	0.8	15.9
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.3	15.4	—	1.4	0.4	17.6	0.9	18.5
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	25.4	—	—	0.1	25·4	0.1	25·5
North-East Coast	1.8	51.4	—	0.9	0.4	53.0	1.5	54.5
Scotland	2.4	25.0	—	0.9	0.6	27.5	1.4	28.9
Staffs., Shrops., Worcs. and Warwick	—	13·8	—	0.7	0.7	13.9	1.3	15.2
S. Wales and Monmouthshire	6.5	59.5	5.6 (basic)	0.9	0.1	72.0	0.6	72.6
Sheffield (incl. small quantity in Manchester) ..	7.5	20.4	—	7.9	0.5	34.5	1.8	36.3
North-West Coast	0.5	1.3	4.2 (acid)	0.3	0.1	6.3	0.1	6.4
Total	20.0	215.3	20.8	14.6	3.1	265.3	8.5	273.8[1]
June, 1952	22.9	246.7	22.1	17.1	3.7	301.9	10.6	312.5
July, 1951	21.7	195.7	20.1	15.3	3.3	247.5	8.6	256.1

TABLE III.—*Weekly Average Deliveries of Finished Steel.*

Product.	1950.	1951.	1951. June.	1952 May.	1952 June
Non-alloy steel :					
Ingots, blooms, billets and slabs[4]	3.6	4.0	3.9	5.1	4.3
Heavy rails, sleepers, etc.	11.3	10.1	13.1	10.1	12.2
Plates ⅜ in. thick and over ..	40.0	41.0	45.5	42.6	41.2
Other heavy prod.	40.2	39.9	44.1	40.7	41.9
Light rolled sections and bars ..	47.6	47.1	47.8	47.2	48.4
Hot rolled strip ..	19.4	19.5	21.1	19.5	19.1
Wire rods	16.3	16.1	16.7	16.6	16.2
Cold rolled strip ..	5.5	6.0	6.6	6.7	6.3
Bright steel bars ..	6.3	6.6	7.2	6.7	6.2
Sheets, coated and uncoated ..	30.5	33.5	35.0	38.6	38.8
Tin, terne and blackplate ..	14.3	13.9	15.7	16.7	16.0
Tubes pipes and fittings	20.0	22.0	23.6	26.1	24.4
Mild wire	12.5	11.9	12.3	14.2	13.3
Hard wire ..	3.5	3.7	4.0	4.2	3.6
Tyres, wheels and axles	3.5	3.7	4.5	3.7	3.3
Steel forgings (excl. drop forgings) ..	2.2	2.3	2.4	3.1	3.1
Steel castings ..	3.5	3.8	4.7	4.3	4.4
Tool and magnet steel	[7]	[7]	[7]	0.6	0.5
Total	280.2	285.1	308.2	306.7	303.2
Alloy steel	10.6	12.3	13.7	16.9	14.8
Total deliveries from U.K. prod.[5] ..	290.8	297.4	321.9	323.6	318.0
Add : Imported finished steel ..	3.8	4.9	4.3	15.4	14.5
	294.6	302.3	326.2	339.0	332.5
Deduct: Intra-industry conversion[6] ..	55.6	61.5	63.6	76.7	76.4
Total net deliveries	239.0	240.8	262.6	262.3	256.1

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys in July*, 1952.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	25	—	16.4	24.8	1.3	—	42.5
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire .. Yorkshire (incl. Sheffield (excl. N.E. Coast) ..	5	—	6.5	—	—	0.7	7.2
Lincolnshire ..	13	—	27.5	—	—	—	27.5
North-East Coast	25	7.4	40.8	0.3	—	1.6	50.1
Scotland	9	0.8	11.9	3.3	—	—	16.0
Staffs., Shrops., Worcs., and Warwick ..	9	—	7.8	1.6	—	—	9.4
S. Wales and Monmouthshire	9	3.1	28.1	—	—	—	31.2
North-West Coast	8	15.7	—	0.2	—	1.8	17.7
Total ..	103	27.0	139.0	30.2	1.3	4.1	201.6[1]
June, 1952 ..	103	26.5	139.2	29.7	1.4	3.1	199.7
July, 1951 ..	99	25.4	122.7	30.1	0.9	3.3	182.4

[1] Five weeks.

[2] Weekly average of calendar months.

[3] Stocks at the end of the year and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] *i.e.*, Material for conversion into other products also listed above.

[7] Included with alloy steel.

Brassfoundry Finishing Methods*

By F. Wild

This Paper reviews available methods and machinery for performing intermediate and final operations on general brassfoundry components. Subsequently plating procedures available are briefly described and their limitations and potentialities discussed. The Author supplemented the Paper with photographs of plant and samples of finished plated castings and other components. During the past five years there have been considerable developments in metal-finishing and this account briefly surveys modern practice. Instead of being regarded as a necessary evil, it is now realized that it is the finish which in many cases sells the article. This change has occurred with the spread of technical information on metal-finishing, and with this has come the gradual disappearance of the so-called "black magic" type of plater, as modern high-speed processes demand the services of operators having a fair technical knowledge. Specification plating, which was brought into prominence during the war, has left its effect to a marked degree, and nowadays customers demand plating on brassfoundry ware to given thicknesses instead of something which is merely bright and shiny.

One of the objects of the Brassfoundry Conference is to discuss American practice, but the metal-finishing industry in this country is under somewhat different circumstances from American industry. Despite claims in the Press, American practice is not always the best applicable to British industry. Whereas the demand is large in the United States and large plants using mass-production methods and automatic processes have tended to eliminate the small factory, in this country the reverse is the case, and the application of automatic process machinery would not be economical in view of the smaller output from individual factories. It is proposed to deal with metal finishing as applied to the brassfoundry trade under four main headings, polishing, cleaning and pickling, plating, and lacquering.

Polishing

Polishing of brassware has been a cost item of major importance, and economies have been attempted in several different ways, notably by barrel polishing and deburring, automatic polishing, electro-polishing and chemical polishing. Barrel polishing has now developed from a tumbling operation to a highly-specialized process and the results obtained are exceptionally good, although a final finish is not always produced. However, even where hand-finishing is required, the cost saving on initial polishing is considerable.

Modern barrel plant fall into two types, the submerged type, and the totally-enclosed type. The submerged type consists of a perforated steel barrel, generally wood-lined, mounted in a tank fitted with heating coils and a trap door at the bottom. The barrel is loaded with fixed amounts of selected abrasive and ware, and then is revolved in a warm soap solution contained in the tank. Various grades of abrasive are used depending on the amount of cutting or polishing required and also on the type of metal being polished. In this process, any metal or abrasive sludge formed is immediately removed from the barrel by the washing action of the solution, leaving a clean cutting surface for the abrasive. The work is removed from the barrel by tipping out on to the sloping bottom of the tank, followed by removal through the trap door. The second type of barrel is the totally-enclosed type, which is constructed of either wood or wood-lined steel, and the ware, together with abrasive and solution, is all contained in the barrel.

Again, various types of abrasive are available, but this process suffers from the disadvantage that the sludge formed is difficult to remove from the work after polishing. Large castings, which would not be suitable for loose barrel polishing, are being successfully processed by means of jigs fixed inside the barrel to which the pieces are clamped. In some cases, the direction of barrel rotation is reversed after a given time so that more even polishing is produced.

Manual polishing still requires the services of skilled operators, although there have been some minor changes in equipment. These changes can be classified as (1) the use of the air-flow type of mop; (2) the use of the backstand idler machine; (3) the use of automatic polishing machines; and (4) the use of pre-polishing (which is a difference in technique). Although greaseless polishing compositions and spray-application compositions are used to some extent in the United States, there is comparatively little use of either in this country as yet.

Machinery

The air-flow type of mop is used widely in the United States, and its use in this country is gradually increasing. It permits the use of higher application pressures and speeds without "burning," thus the time in the actual polishing operation can be reduced. The mop life is also longer due to the cooling effects. This type of mop is also extremely useful on automatic polishing machines, where the mop is subjected to long operating periods with little chance for cooling. It is constructed from material folded into such sections that a flow of cooling air is forced through the mop whilst it is rotating.

Another item of equipment is the backstand polishing machine. This employs an abrasive-coated

* Paper presented to the Brassfoundry Productivity Conference; the Author is on the staff of R. Cruickshank Limited, Birmingham.

belt, which runs between a spring-loaded idler pulley and a felt- or rubber-covered contact wheel, which is fitted to a normal type of polishing spindle. It is relatively simple and almost any polishing spindle can be converted easily. The belt is supplied with various grades of abrasive and the hardness or resilience of the contact surface can be readily adjusted by the use of contact wheels of varying hardness. Advantages to be gained from this type of polishing are numerous. Cutting is very even and there is freedom from glazing. The belt surface between the contact wheel and the pulley can also be utilized for certain designs of casting where polishing on a round bob would be impracticable.

Pre-polishing, by which is meant the initial polishing of articles before forming, reduces the amount of skilled polishing labour, as the shape of the article before forming is generally simple. This practice is being used widely in the United States and also to some degree in this country. It cannot, of course, be said to apply to cast brass, but many components which go along with cast-brass articles are made in the press shop.

Automatic polishing machines are only applicable where there are continuous runs of the same component, such as in large manufacturing plants. In some cases a finish is produced which requires no further treatment, but even where this is not the case, the amount of manual polishing is reduced considerably. This type of polishing is particularly suitable for simple shapes of fairly even contour. The rotating table type of machine, for example, is one in which the articles, held on chucks, are brought under suitably-mounted polishing heads for given periods of time. The table is of the indexing type and, when each operation is completed, it rotates on to the next operation. Another type of machine is the straight-line conveyor on which the articles in continuous motion pass under various polishing heads. In this machine, the polishing heads are generally of the fully-floating type, self adjusting to the contour of the article. For certain types of article, such as large domed shapes, a rotary movement as well as the conveyor movement is also incorporated.

The centre-less polishing machine, with a special attachment, is being used for mass-production polishing of sink-waste outlet pieces and, of course, a universal polishing machine would be suitable, but in general one finds that most machines are designed for one particular article or type of article.

Electrolytic and Chemical Polishing

Electrolytic polishing has received some publicity, and there has been a considerable interest in it as a means of reducing manual polishing. Unfortunately, both in this country and the United States, its applications are rather limited. It is being used successfully for the polishing of stainless-steel and aluminium and has been used commercially for polishing brass. Although when operated correctly, the process produces a bright finish, considerable preliminary rough polishing is needed before castings or pressings are suitable for it. It suffers from several disadvantages: large articles cannot be successfully polished, due to marks on the surface known as gas striations; the solution is expensive and needs careful control; electrical current consumption is high, and large rectifiers are needed. One plant in the Midlands, operating on small brass articles, closed down some years ago due to the foregoing reasons. Work is still being carried out with the object of producing more suitable solutions, but as yet there would appear to be much development required.

Chemical polishing, which should not be confused with electrolytic polishing or bright dipping, is being used on brass, nickel-silver, and aluminium with some success and, although the finish produced is not mirror bright, there is considerable smoothing and the resulting finishes are quite lustrous. The process is being applied commercially in this country to small brass articles, where a bright finish is required, but where the cost of mechanical polishing would not be warranted. Articles polished by this method can be subsequently bright-nickel-plated and the results are quite good. As mentioned earlier, this process should not be confused with bright dipping in which there is no smoothing effect, and for which the results obtained are quite inferior. Various solutions are used, depending upon the metal being polished, but the equipment required is somewhat expensive, as the tanks (which are of stainless-steel) must be heated and fitted for fume extraction. However, for certain types of small brass work, the process has a definite field of applicability.

Bright Dipping

Bright dipping, which was the "cinderella" of many factories, is now receiving more attention, and many modern dipping shops are very well planned. Hot chemical degreasers are now used, and most shops have pre-dipping tanks containing spent acid. These practices have helped in reducing acid consumption, and also reduced the number of rejects produced by excessive etching of the brass. On the subject of bright-dipping, a new type of dipping cabinet which has recently become available might be mentioned. This cabinet is constructed of acid-resistant material, and the dipping and swill tanks are inside it. The operator works from the front of the cabinet and all fumes are removed by fan. These fumes pass through an ammonia chamber followed by a filter and when they reach the atmosphere all traces of acid have been removed. Thus, it will be seen that the plant is highly suitable for use in such places as machine-shops, and the transport of work to an external dipping-shop between various machining operations is eliminated.

Degreasing and Chemical Cleaning

Degreasing has become a problem of some importance owing to the current trichlorethylene shortage, although the position is somewhat easier at the moment. Emulsion degreasers are being used both here and in the United States with considerable success. With this type of degreaser, the work is immersed in a tank containing the degreasing solution after which it is rinsed

well in water. The principle is that the grease dissolves in the solvent and when the work is rinsed, the grease, solvent and water form an emulsion which is washed away. Afterwards, the work is either dried or passed on to the next process. This method of degreasing is not so effective as trichlorethylene, and unsuited to the lacquering process, but it is cheaper than when trichlorethylene is used.

Chemical cleaning has undergone a considerable change in the past few years, particularly since the widespread use of bright-nickel solution and the old type of "soak" cleaner is being replaced by more modern electrolytic cleaners. There is a gradual trend to the use of anodic cleaning, sometimes in conjunction with cathodic cleaning, and sometimes on its own. Widespread use is made of anodic cleaning in the United States, and the trend in this country can be said to be following American practice. Pumice scouring is another practice which is being outdated, although it must be admitted, that on certain types of work, particularly castings, it is sometimes necessary.

Plating

Nickel plating, where it is still permitted, has undergone many changes in the last few years; from "dull-nickel" to "cobalt-bright-nickel" and now "organic-bright-nickel." Dull nickel plating is still quite extensively used, and although it is a more expensive process to operate owing to higher finishing costs and extra handling, many platers still prefer it for the ductility of the coat, and ease of control. Organic bright nickel solutions have largely replaced the "cobalt" type, mainly due to the relatively high chemical maintenance costs of cobalt solutions. In general, it can be said that the organic bright solutions have greater levelling power, and produce more lustrous deposits than the cobalt variety. The colour of the deposit produced from organic solution is that of a true nickel, whereas the cobalt produces a whitish-coloured deposit.

Although nickel is in short supply, much can be done for its conservation, and many economies have been put into operation by platers to combat the shortage. The use of anode-saving baskets into which scrap anode pieces are put has saved much nickel which would otherwise have gone to a scrap-merchant's yard. Insulated jigs have also contributed to the saving of much nickel, although the Author fears that nickel is still wasted to some extent by the use of uncoated jigs. The use of jigs is not advocated for all classes of work, and particularly where the types of casting vary considerably, or are in small batches, when the use of copper wire is unavoidable.

Careful control of solutions does not require the day-to-day services of a chemist, and much nickel can be saved by reduction of rejects, this being apart from the cost of re-plating them. Many platers unfortunately still only turn to simple every-day instruments such as hydrometers, thermometers, and *p*H comparitors when they are in trouble, but the Author's experience shows that many of the troubles of platers need not occur if a small amount of control had been instituted.

Tin/Nickel Plating

Despite many economies in using nickel, platers must turn their attention to alternatives, emphasising *alternatives*, and not *substitutes*. In spite of many claims, there are as yet no proper substitutes for nickel. Alternatives for nickel plating are the tin/nickel, copper/tin bronze, periodic-reverse bright-copper, acid bright-copper, speculum, white-brass, and bright-zinc plus lacquer processes.

Tin/nickel is deposited from a solution containing nickel- and tin-chlorides together with fluorides and free hydrofluoric acid. Tin and nickel anodes are used, the solution being contained in a rubber-lined tank. Constant filtration is necessary, and the anodes must be bagged in terylene cloth. Owing to the hydrofluoric-acid fumes given off, fume extraction is a necessary adjunct. The deposit from the bath is semi-bright and is easily buffed, the colour being almost that of a pure nickel deposit. The alloy deposited is of 30 per cent. nickel and 70 per cent. tin, and a Board of Trade licence is thus required for its use on articles coming under the nickel restriction order. Another difficulty attached to this process is the fact that the deposit will not later accept chromium and troubles may arise where articles have to be colour matched against chromium.

Tin-bronze plating, however, will accept chromium plating subsequently, and the use of this solution does not come under the nickel restriction order. The solution is one containing sodium stannate, copper cyanide together with sodium cyanide and caustic soda. It is used hot and is contained in an iron tank. The anodes are of a copper/tin alloy containing 12 per cent. of tin. The solution requires simple chemical control for, when the tin content of the deposit rises above 15 per cent., difficulty in chromium plating is experienced. The deposit is a pale pinkish-yellow colour and requires buffing before chromium plating.

Copper Plating

Bright-copper plating has aroused a considerable interest and three main types are available, two of which are cyanide solutions and the third an acid-type solution. Periodic-reverse or, as it is more generally known P. R. copper-plating is being used considerably in the United States to replace nickel. The principle of this process is the reversal of the current for given periods of time during plating. This reversal removes any high spots in the deposit, and produces a smooth mirror-bright surface. The solution, which is of the cyanide type with an inorganic addition agent, is used hot with constant filtration and air agitation. Owing to the nature of the process, the deposit produced is of fine-grain, ductile, pore-free copper with a hardness nearly equal to nickel. This question of hardness of undercoats for chromium plate is of some importance, when it is considered how thin chromium deposits are. Another important feature of the process is the levelling power, whereby polishing marks are filled in during plating.

The second type of cyanide process employs a hot cyanide solution together with an inorganic

brightener contained in the anodes. In this type of solution, mechanical agitation is used, together with constant filtration. Although bright deposits are produced, there is very little levelling and polishing marks are not removed as in the P.R. cyanide process. The bright-acid copper process employs a solution of copper sulphate and sulphuric acid together with organic brighteners used in a lead- or rubber-lined tank. Bright-copper plating is produced from this solution suitable for direct chromium plating. The deposit is not as hard as with the P.R. cyanide method, although the solution has some levelling properties.

Other Coatings

Speculum metal is an alloy of tin and copper, white in colour and fairly easy to buff. It does not plate "bright" and subsequent buffing is necessary. Such a plating will not accept chromium, which makes it difficult to match with other chromium-plated articles. Speculum metal is plated from a solution of sodium stannate and copper cyanide together with caustic soda and sodium cyanide. The solution, contained in an iron tank, is used hot and a dual anode circuit is necessary as two types of anode are used, one of tin and the other of copper. The process requires to be chemically controlled if deposits of the correct composition are to be obtained. A limited amount of work only is being plated by this process, but on the whole the results are quite good. Incidentally, the process is operated under licence arrangements.

White-brass plating is being operated in the United States, but as yet there is little done in this country. The deposit is bright and will accept chromium, but there is a paucity of information available as to its service life.

Bright-zinc plating is being used extensively and, when correctly operated, the process produces a finish almost identical in appearance to chromium, but it is not satisfactory without a protecting lacquer. The solution, however, is easy to work and the equipment required is not elaborate. A conventional zinc-cyanide solution is used in conjunction with brighteners, and bright dips are used after plating. The process is being used extensively in the United States for internal brass fittings, such as handles, which are not subject to heavy wear.

Lacquering

A considerable amount of brassware is not plated, but is lacquered after polishing, and it is proposed briefly to discuss developments which have taken place in this field. There has been little change in the principles of actual application, although modern mass-production methods have produced automatic lacquering machines both of the spray and dip type. Of the preliminary degreasing before lacquering nothing need be said, as members are doubtless conversant with the methods used.

The types of lacquer in use to-day are:—

(1) The shellac type—these are the oldest and can be applied either hot or cold. They are not much used nowadays for polished brassware, as the lacquer is of rather a brown colour.

(2) The nitrocellulose types, which are used extensively, can be sprayed, dipped or brushed on to the brass. They are air-drying, although oven-drying is often used in order to reduce production time.

(3) Synthetic types such as the phenol-formaldehyde, urea-formaldehyde, methacrylate, vinyl and melamine lacquers are, in general, stoving lacquers, although some are air-drying, though with the air-drying types the lacquer film is generally too soft. These types are replacing the nitrocellulose lacquers in many applications, due mainly to exceptional hardness and wear resistance. When stoved, they are extremely resistant to nearly all types of solvent, and also to chemicals which would normally attack nitrocellulose lacquers. These lacquers are very widespread in the United States, and their use is increasing in this country. Some examples of this type of lacquer have the ability to withstand a lighted cigarette being stubbed upon them.

Applications Methods

As mentioned, methods of application of lacquers have not changed except for the application of mechanization to them. Dipping can be varied from the rapid hand-dipping to the slow, mechanical-extraction machine, which withdraws work at such a slow rate that runs and tears are eliminated. The process is also used on conveyors, and by combining infra-red heating units into the conveyor line, a complete automatic dipping and stoving units is produced. Rotary or up-and-down movement is sometimes combined with the slow-extraction, particularly where awkward shapes are being dipped. This movement can be produced by moving the lacquer tank mechanically or by additional motion imparted to the work being extracted. Where slow extraction dipping is not practised and production is large enough to warrant it, electrostatic de-tearing is employed. In this process, the work passes near to high-voltage electrodes which attract any surplus lacquer or paint tears from the work. The equipment for this is relatively expensive and its use is limited to large automatic plants.

Bulk dipping of small articles, followed by centrifuging to remove excess lacquer has been used for a number of years, but the Author draws attention to a novel machine. In this, the work is loaded into the basket and the sliding door on the machine is then shut. The lacquer which is contained in a tank inside the machine is brought up to the work basket by raising the lacquer tank, using a hand lever. The tank is subsequently lowered, the basket allowed to drain, and then excessive lacquer is centrifuged off by mechanically rotating the basket. By this method excess lacquer is not wasted but runs back into the dipping tank. Arrangement is made on this machine for the

(*continued on page* 400)

Process Control in Vitreous Enamelling*

Discussion of Mr. H. W. Clewes' Paper

The Paper was provocative, as it enumerated many aspects of control and organization for enamelling which were comparatively new to the majority of enamellers. Thus, much attention concentrated on detail interpretation of such items as pickling acid control and testing, spray-weight checking, liaison between staff, shot-blasting equipment and shot sizes, relative merits of different furnaces, and atmosphere checking. The status of the control system in the economy of the plant was touched upon and its worthwhile nature was confirmed by several speakers.

MR. C. P. STONE, opening the discussion, complimented Mr. Clewes on a very good practical Paper. It was a demonstration of the importance of control, to establish a good standard at the inspection. Mr. Clewes had rightly pointed out that despite perfect manufacture of a part in cast iron or steel, the operation of vitreous enamelling could be ruined unless control of the process was in operation, particularly in the mill room. In how many cases was it found to-day that when a shop grumbled about colour and finish, if process control had operated in the full sense of the word, that the fault would never have occurred? Mr. Clewes' point of view would receive the full support of the Institute who were associated with the B.S.I. with regard to standards. It was a matter which he thought was now becoming urgent.

Mechanization and Control

MR. A. J. BIDDULPH said he had been struck by Mr. Clewes' references to mechanization. A considerable increase in output per operator had been achieved in the industry during the last ten years with savings in cost as compared with what it would have been without mechanization, and it was likely to be an increasing feature of the industry as time went on. However, mechanization and all the benefits that it brought with it, both as to quality and cost and the ability to use unskilled labour, could only be utilized if there was closer control of both materials and methods.

In Table II of the Paper were given some details of pickle-room control and he would like Mr. Clewes to amplify that as regards alternative methods of test. Some firms used titration and others, perhaps with fewer trained staff went in for tablets but, undoubtedly, tablets were not accurate. Could Mr. Clewes express an opinion on the degree of accuracy necessary and as to the relative merits of the methods. Also, could he say something about the limits to the strength of solutions; he gave the specific strength as 7 per cent. for sulphuric acid, but no doubt 7.1 or 6.9 per cent. would be equally effective, whereas possibly 10 per cent. or 4 per cent. would be unsuitable. What frequency of testing was necessary, daily or weekly?

Mr. Clewes had suggested that in the dipping tank, dip weight should be tested every hour, with which he quite agreed, but on the matter of spray weight he saw no mention of checking, other than a check after firing. He would like the Author's ideas on whether spray weight should be checked also whether he would check on all points covered by spray or would put through a test-piece as a check. Further, what limits of spray weight would he recommend?

Pickle Solutions

MR. CLEWES said the pickle solution strength might be varied a great deal depending on the through-put. His firm had an automatic pickling plant, with what was considered a big through-put and the solutions deteriorated quite rapidly. The strength of the acids were tested twice daily and twice during the night, on a 24-hour cycle. The iron content was tested once weekly and this was considered sufficient. As regards accuracy, there was no point in instituting a procedure for testing in the laboratory, which could not be maintained in practice. For instance by the method adopted of making a sulphuric acid addition, it was quite impossible to measure it to less than a gallon and they had come to the conclusion that within a gallon was sufficiently accurate. With sulphuric acid as low as 5 per cent., at that figure there was a tendency to under pickle and 6 per cent. was certainly as low as could be accepted. On the other hand 7 per cent. was all that was necessary and they would not attempt to use 8 per cent. acid. As to test solutions versus "pickle pills," his firm felt that laboratory-trained personnel would insist that the method of testing should be by solutions. Checking spray weight had not been instituted as a control procedure as yet. In fact, he was not convinced that that was the method by which to control of spraying. As mentioned in the Paper, in practice it had been found that checking the biscuit thickness was a good way of controlling the spray. When the sprayer had got a fair number of pieces sprayed, the thickness of the biscuit was checked, and related to the "fired" job.

Liaison

MR. BAKER, in stressing the necessity for arranging complete liaison between the control team and the supervisory staff in the shop, said very often the control team consisted of young people, thoroughly trained but who had not been in the industry very

*Paper presented to the Southport Conference of the Institute of Vitreous Enamellers and printed in the JOURNAL, September 4, 1952.

long. On the other hand, the supervisory staff might have been there a long time and rather resented the intrusion of young technicians who gave instructions on how to proceed. It had been found that if the control was carried on so that the supervisory staff could see what was being done and were shown the effects of lack of control, they more readily appreciated the value of that control. It was the responsibility of management to see that the reports and recommendations of the controllers were carried out.

MR. CLEWES said the control should be such as to provide for the shop supervisor a system from which he knew, providing his processing was correct, he would get the desired results. He felt that process control was a part of supervision; in small shops it might be that it came directly under the jurisdiction of the shop supervisor. On the other hand, in bigger organizations the responsibility might be divided, but ultimately both shop supervisor and the control staff were concerned with the results of their processing, and the final product was their joint concern and responsibility.

DR. HURST requested a little enlightenment on Table III, where the descriptions of the types of machines seemed somewhat unusual. He could imagine what was meant by a "flat Wheelabrator" and a "round Wheelabrator," but he did not quite know what was meant by a "box." Then in the second column it was stated that so much shot was added in the 24 hrs., and yet later "per week" was quoted.

Also, what was meant by the dust mentioned? A maximum of 20 per cent. of fines was said to be satisfactory for what was called "the round Wheelabrator" and 7 per cent. for the "box type." Was the dust metallic or was it dust from the castings? Finally, to describe a screen as 60 mesh or 20 mesh was just meaningless. The only description that was of any use in connection with mesh was aperture size. Much confusion was caused in descriptions of screens through neglecting to give the size of the aperture. For example, for 60-mesh cloth there were five commercial grades which gave five different aperture sizes.

Other Cleaning Methods

MR. CLEWES said at the outset he would like to make it clear that his firm were not satisfied with their control of shot blasting, and were at the moment carrying out an investigation to assess the possibility of improving the control of that section of the processing. Regarding the tables, by the "flat Wheelabrator" and the "round Wheelabrator" were meant the automatic type of the shot-blasting machine as distinct from the box-type where the operator worked inside a room or cabinet.

The "round Wheelabrator" was of the tumbling-barrel type, while the other model was a flat table or a continuous belt passing under the blast as distinct from the box or cabinet model. The "per week" referred to the 3-cwt. rate quoted and was the consumption of shot in the cabinet-type of machine. The 16-cwt. figure was for the shot consumption of the flat Wheelabrator in 24 hrs.

The dust referred to was that from the shot-blasting system extracted by the exhaust fans, and was a combination of fine shot and casting dust. As to screens, he would like to make it clear that many tests carried out in process control were not to determine exact values. Providing that a test was carried out repetitively under identical conditions, he did not think there was any need to worry about actual values. Normally, British Standard screens were used.

MR. J. H. GRAY thought Mr. Biddulph's method of testing the "biscuit" was a very good one, but he could not help but feel that if it was combined with a density check prior to spraying, the two would provide a double control which would be a better safeguard. In connection with the testing of sheet-iron ground-coat enamel, had Mr. Clewes ever considered dispensing with the dip-weight test entirely, checking only the density of the enamel at the dip tank? Having determined this as being correct, a few sheets could be dipped and the biscuit thickness checked. This thickness could then be adjusted in either direction with the aid of setting or de-setting agents, the density remaining constant. That was a useful method if a plant was swilling both new sheets and de-enamelled sheets, as sometimes one needed a heavier deposit of enamel on the latter. Two tanks could be used and the enamel controlled in each to a given density and thickness.

MR. CLEWES said including density as a test of spraying was certainly done for the slurry as delivered to the sprayer, as he had suggested in the Paper. The specific gravity had already been checked as well as the slump test which gave an indication of the density.

Regarding the question, which was often encountered in production, of a difference in the surface of the pickled sheet, particularly as between the de-enamelled and new sheet, he agreed that it was a help to check the thickness of the deposit. Fundamentally, however, the dip weight gave the direct relationship to actual production conditions. An essential point was that as far as possible the tests should be designed so as to compare strictly with production conditions.

A dip-weight test was carried out, the operator began swilling, and then the thickness of the biscuit was checked. That, he thought, was more or less what Mr. Gray had been suggesting.

MR. GRAY felt that although enamellers could get a "firing" check-weight per sq. ft., or per two sq. ft., there was not always the same coating when spraying an intricate design. At the dip tank, the test could actually be made on the articles which were going to be dipped in production to secure a far better idea of how the finished job was going to turn out.

MR. CLEWES said on a mass-production job when swilling day after day the same group of components once having established a satisfactory dip weight there was little variation subsequently. If it was being suggested that there should be a different

dip weight for different types of pressings, that to a certain extent was true.

"U"-type Furnace

MR. S. E. A. RYDER said he would like more information on the control of the "U"-type continuous furnace; it was mentioned that "settings of gas rate, damper and air inlet were varied according to the temperature and time cycle required." He did not quite see how that could be effectively done on that type of furnace with an air-blast type of burner, particularly for the air-inlet setting. On the question of maintaining negative pressure in the flues, Mr. Clewes had mentioned that the pressure was measured at the stack. His own experience had been that it was more difficult to maintain a negative pressure in the flues of this furnace than it had been with the box-type of furnace using a similar burner. Also, it had been found more difficult to maintain a given type of atmosphere in the muffle of the new type of continuous furnace than it had been with the box furnace. The flue was a long way away from the combustion flames, further than with the box-type and measurements at the stack were not a good indication of the condition in the combustion as with the earlier furnace. There was a back-pressure difference between the base of the stack and the combustion flues, which was perhaps not surprising when it was remembered that air was being pumped into the flues at 1 lb. per sq. in. For that reason, it was more difficult to maintain a really satisfactory atmosphere.

MR. CLEWES said he feared the paragraph referred to was not at all clearly expressed. The conditions laid down regarding the gas rate, damper setting and air inlet applied to the box-type muffles. Neither the gas rate nor the damper on the continuous furnace was altered. With regard to the muffle atmosphere, his firm's experience had been exactly the reverse. They were very pleased indeed with the continuous furnace and felt from the various checks they had done on the muffle atmosphere that it was a big improvement on the box-type furnace.

Regarding the control of the negative pressure in the flues, there again the negative pressure in the flues was much more constant than it was on the box-type furnace. The continuous furnaces had been in use since 1948 and had not yet been down for a major overhaul. Throughout that period there had been checks on the atmosphere and the pressure in the flues, and they were fairly constant.

Shot-blasting

MR. B. B. KENT asked why such a coarse shot as 10 was used in the flat-type Wheelabrator and 16 in the table type. Surely the principle of operation was the same in both. He had found in working with Wheelabrators that the cleaning might be quicker, but wear on all parts of the machine was very heavy indeed.

MR. CLEWES thought the difference might be in the product or the type of casting that it was intended to enamel. The procedure was not at present standardized.

MR. BAKER said his firm's flat Wheelabrator was purchased some years ago when their work was mainly of a flat nature, but now it had changed and the machine was not so suitable, but they also stripped all rejected work on it. Coarser shot was used, because it helped to break up the surface better than the finer shot.

MR. RYDER confirmed that if they used shot coarser than No. 16 in the flat-type Wheelabrator, they wore away the machine casing as well as cleaning the castings.

MR. BIDDULPH, on the question of furnace atmospheres, pointed out that the stack was much further away in the continuous than with the box-type furnace, and the negative pressure on the stack was not always so close an approximation to the flue pressure. So far as the working atmosphere was concerned, there was one point which Mr. Ryder had not mentioned. That was that in a box-type furnace the furnace door was being raised and fresh lots of air were entering, perhaps five, six, or more times per hour. The cold air entering was newly heated and there was an air change. This was not a feature of the continuous furnace. In fact, it had been pointed out as a fault that the air was not changed, although vents were provided for the purpose. An accumulation of water vapour was possible in a furnace atmosphere from the enamel and, unless there was adequate venting, an unsuitable atmosphere could be built up.

DR. H. W. WEBB said he was always appalled at finding a sieve-test used for fineness because his experience was that it gave no reasonable indication at all of the fineness of grading of a ground sample—where a fair proportion of the particles were less than 0.01 mm. equivalent diameter. It was an extremely loose control. Presumably, Mr. Clewes's reply would be that it worked, but there were several very rapid fineness tests which were accurate and he was sorry they were not used.

In industry, control had to be applied throughout the whole operation and an essential part of control was to be able to persuade workpeople to do the things required in the right way and for that reason he had rather missed in the Paper some indication of how difficulties were dealt with, say, by first making a defects analysis on the week's working; secondly, calling together those responsible for the shop control and so on, having a *post mortem* on the job and issuing further instructions. Certainly, in the section of the ceramic industry with which he was concerned, process losses were more due to workpeople, to handling and to inattention than they were to any lack of technical control.

Another point was that it was important in industry to know the cost of control in relation to results. When instituting control laboratories and staff there was a natural tendency for the laboratory staff to want to do all sorts of tests, some of which were only of theoretical interest, until it was found that the cost was becoming an important item of expenditure. At some stage someone had to say "You prove to me that the control you apply to a

particular section of production can bring in enough economies to justify the expenditure on it." That, he thought, was a salutary lesson for someone who was purely laboratory minded and wanted to create a fresh section in an industrial unit.

His third point was that in control tests there were several principles operating. Mr. Clewes had mentioned one—that the order of accuracy should only be that needed for the control, and anything more refined was a waste of time and money. A second point was that speed was essential in control tests; some accuracy could always be sacrificed if there was a gain in speed. It then meant there was a real control test and not a *post mortem*. He had been impressed by Mr. Clewes' practical outlook for he had become accustomed to meeting laboratory control men who thought almost purely in scientific terms, not in terms of costs.

MR. CLEWES agreed that control in vitreous enamelling should be on the job in the shop. In his works there was a system whereby a record was kept of inspections and the reasons for rejections, which was reviewed constantly. In fact, a process-control man, living on the job, should know of the rejected product before it reached the inspector. Regarding the cost of control, he had always taken the view that as he was still employed, the control system must pay.

Vote of Thanks

MR. LAITHWAITE said that he was sure all would agree in welcoming Mr. Clewes as a lecturer and as an encouragement to others who might be hesitating in coming forward with contributions to the Institute. The industry as a whole, if it was not moving towards uniformity, was at least thinking along those lines. As to the cost of control systems, he could say that his own company were convinced that without control they could not continue to operate to a high-quality standard. Their experience had been that one did not, within limits, *spend* money on control, one *invested* it and the return more than justified the expense. Mechanized methods could not be operated without control. His own office at any time looked like a mortuary and he lived in an atmosphere of *post mortems*. That, he thought, was true of most people in the industry. With mechanization of processes, a lot of money could be lost if something went wrong. Under such conditions one had to act quickly and control made that prompt action possible.

THE CHAIRMAN, closing the meeting, said he thought he could not do better than echo MR. LAITHWAITE's remarks. It was Mr. Clewes's first paper and the Institute would prefer many more first papers rather than second, third or fourth papers from members who had already given previous ones.

The vote of thanks was accorded with hearty applause.

Brassfoundry Finishing Methods

(*continued from page* 396)

direction of basket rotation to be reversed so that even lacquering takes place. It is claimed that the whole operation of lacquering and centrifuging can be carried out in 30 secs. Spraying is still the chief method of lacquer application, due to its relative ease and the high rate of production. The method is rather wasteful in lacquer, but has the advantage that any shape of article can be sprayed, as well as having a lower labour cost in comparison with hand dipping.

Plants embody simply the application of spray-guns to the work running on conveyors, the work sometimes being given a rotating motion. Plants are generally designed by spray-gun manufacturers and many are in use in both this country and the United States. Lacquer is fed to the guns by pipeline from a main supply tank and the guns, which in some cases are trip operated, are mounted at various angles.

Electrostatic Spraying and Hot Lacquering

Automatic, electrostatic spraying of lacquer is used in many large plants in the United States, but, again owing to the expense of equipment, its use is limited. In this process, the lacquer spray is passed through a charged screen and the work is charged at opposite polarity. The lacquer spray is thus attracted electrostatically to the work and on articles not having deep recesses the coverage is good. Unfortunately, auxiliary electrodes are required for deep recesses, a factor which puts considerable limitations on the process.

The hot lacquer spray process is used for the production of thick coatings by one spraying, and would not have much application to polished brassware. The principle lies in the fact that lacquer has a lower viscosity when heated, and thus the use of thinners is reduced. By this means, lacquers of high solids content can be used, producing much thicker coatings. The lacquer is circulated continuously through a heater-tank and the guns used are ordinary spray guns.

Booths

Water-wash spray booths are used extensively in America and their use is spreading here in this country. They are cleaner to operate, and paint spray is completely removed from the exhausted air. Reclamation of the lacquer solids from the water is practised in the States, but there is no evidence as to this practice being adopted in this country.

AFTER the Leven engineering firm of Henry Balfour & Company had written to say certain sections of their work might have to close down if houses could not be found for key men, the town council decided to consider ten applications.

DIRECTORS of G. & J. Weir, Limited, Glasgow, have made presentations and given long service certificates to four employees who have completed 50 years' unbroken service with the firm. They are Robert Law (foundry), George Stirling (foundry), John Wilson (fitter), and John Carnichan (sales department).

F.&M. FERRO-SILICON★ BRIQUETTES

F. & M. SILICON BRIQUETTES

It is well known that the hardness of ordinary cast iron depends to a large degree on the Silicon content of the metal. Silicon acts as a softening agent in cast iron by its action in reducing the amount of combined carbon, which is liberated in the form of free graphite. The presence of free graphite and a low combined carbon content contribute towards easy machineability.

In these days of restricted supplies of good machinery scrap iron and also of pig irons with a wide range in chemical composition, **F. & M. Ferro Silicon Briquettes** provide a practical and economical means of increasing the amount of Silicon in a cast iron. The necessary number of Briquettes is added to the charge in the Cupola and all the Silicon contained in the Briquettes passes into the molten metal with only a negligible loss ***because the element is protected during its progress through the oxidising zone.***

An important function of **F. & M. Ferro Silicon Briquettes** is in the production of dense iron castings with high tensile strength. The foundryman usually ensures sufficient "softness" in his castings by using a pig iron with 3 to 4 per cent. Silicon. Such pig irons are frequently coarse-grained with large graphite flakes and, when used in ordinary cupola mixtures of pig and scrap iron, are apt to give rise to castings containing large graphitic flakes. This coarse-grained structure, which is particularly developed in the thicker parts of the section, results in an iron of comparatively low tensile strength.

By using pig irons of medium Silicon content (2 to 2·5 per cent. Silicon) which possesses a denser structure owing to their smaller graphite flakes, and increasing the Silicon content of the metal by an appropriate addition of **F. & M. Ferro Silicon Briquettes** to the cupola mixture, an iron with much smaller graphite flakes, and therefore, with a denser structure, is produced. At the same time, the metal is readily machineable, although it is denser and stronger, ***as the composition of the metal remains unaltered from that obtained by the use of higher Silicon coarse-grained pig irons.***

Technical advice for any special working conditions gladly given on request

DIRECT FROM MANUFACTURER TO YOUR FOUNDRY

F. & M. SUPPLIES LTD

4, BROAD STREET PLACE, LONDON, E.C.2
Telephone: LONDON WALL 7222 (5 lines)

FOUNDRY & METALLURGICAL F&M.S.L.

★ ***We shall discuss our other Briquettes***

SILICOMANGANESE, FERRO MANGANESE AND FERRO CHROMIUM

in later advertisements

News in Brief

FOUNDRY SUPPLIERS, LIMITED, have changed their address to 25A, Cockspur Street, London, S.W.1. Telephone: TRAfalgar 1141.

AT THEIR AUGUST MEETING the Victorian division of the Institute of Australian Foundrymen heard a paper "Special Castings for the Doxford Engine," by Mr. A. B. Robinson.

THE MANCHESTER ASSOCIATION OF ENGINEERS, 20, Booth Street, Manchester, 2, have sent us a circular announcing their opening meeting of the session on October 3, and a copy of the syllabus of meetings for 1952-53.

WOLF ELECTRIC TOOLS, LIMITED, have recently introduced a novel profit-sharing bonus for both manual workers and clerical staff, which takes the form of a "dividend," and individual shares are varied with normal time-work earnings and years of service.

THE EDINBURGH GROUP OF FIRMS—Bonnington Castings, Limited, Primrose & Company, Limited, and Balbardie, Limited—have received an order worth £250,000 for equipment vital to the National Defence programme. It is believed to be the largest ever placed with a Scottish steel foundry.

THE QUASI-ARC COMPANY, LIMITED, have produced an illustrated pocket-size booklet, reference IB.3, giving instructions for the installation, operation and maintenance of their a.c. portable arc welding plant type ACP.300. Copies can be obtained on application to the company at Bilston, Staffordshire.

A CONFERENCE on the significance of ash and clinker in industry will be held by the Institute of Fuel at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on October 28 and 29. Further information may be obtained from the Institute of Fuel, 18, Devonshire Street, Portland Place, London, W.1.

FOUR WORKERS were burned last week, two of them badly, in an explosion at Gartsherrie Iron Works, Coatbridge. They were taken to Glasgow Royal Infirmary where two of them were detained for treatment. The explosion is believed to have been caused by some iron among slag having come in contact with water.

THE MINISTRY OF FOOD announced on September 6 that the buying on Government account of linseed and linseed oil from overseas would be discontinued. It is now announced that the Ministry of Food will no longer buy home-grown linseed after March 31, 1953, when its undertaking in respect of this year's crop expires.

THE BRITISH ALUMINIUM COMPANY, LIMITED, have opened a Southampton branch office, to handle sales of unwrought and fabricated aluminium and aluminium alloy in the counties of Sussex and Hampshire. Mr. W. H. Marston has been appointed area representative, and the address of the new branch is 20, Brunswick Place, Southampton.

AFTER YEARS of having to depend on England and Wales for supplies of coke with which to process iron and steel, Scotland has at last struck out on her own. A new coking plant, the second largest in Britain, came into operation at the Clyde Iron Works, near Tollcross, recently, which will render steelmakers self-sufficient in this vital commodity.

THE MANAGEMENT of William Asquith, Limited, machine tool manufacturers, High Road Well Works, Halifax, have decided to increase the award to employees on retirement. In recent years the firm has given retiring workers £1 for each year of service, but now the directors have decided to increase the amount to £5 for each year of service for employees who have been with the firm for 20 consecutive years.

"THE STORAGE OF COAL," by Douglas A. Hall, Ph.D., B.Sc., F.R.I.C., which appeared in a recent issue of "The Purchasing Journal," official organ of the Purchasing Officers Association, has been published in booklet form. It has special significance for works where large stocks of coal are carried. Further information as to its availability can be obtained by writing to the Secretary of the Association at Wardrobe Court, 146A, Queen Victoria Street, London, E.C.4.

DR. R. A. MOTT, of the Midland Coke Research Station, Clarkehouse Road, Sheffield, has issued a report on the exhaustive tests carried out over a number of years on furnace coke. Against a background of reiterated statements that the largest single factor preventing a rapid expansion of British pig-iron capacity is the shortage of coke of suitable quality, the report maintains that 1½ in. dia. coke is superior for this purpose to the large coke hitherto thought indispensable for the maintenance of sufficient draught.

SHEFFIELD, with the heaviest deposit of soot per acre in the British Isles, was visited last week by Mr. Henry Burns, anti-pollution chief of Los Angeles. Mental pictures of millionaires' white palaces and sunny promenades were shattered when Mr. Burns pointed out that oil refineries there poured out 250 tons of sulphur fumes daily. He has 23 inspectors on his staff, and £330,000 is spent annually in combating smoke. He carries a deputy-sheriff's badge, and has power to close down any factory where co-operation is not forthcoming.

MR. F. H. SANITER, director of research to United Steel Companies, Limited, recently welcomed 36 undergraduates from English Universities as guests of the company. All are studying engineering, metallurgy or chemistry, and will have the opportunity of seeing many activities of the firm and its associated undertakings. Visits have been arranged to the Appleby-Frodingham works, the Ickles works of Steel, Peech & Tozer, the new Swinden laboratories, and the Stocksbridge works of Samuel Fox & Company. Conferences with senior executive follow each day's activities.

IT WAS ANNOUNCED on September 24 that the Colville group are to increase output. Two furnaces in No. 1 melting shop at Clydebridge Steelwork, Cambuslang, are to go into production this week. This is the melting shop which was first to suffer in 1950 when supplies of scrap and other raw materials reached rock bottom. Last week's announcement is the first news of any major improvement in the steel position. A further 80 or 90 men will be required at the melting shop. With these two additional furnaces in operation output of steel by the Colville group will be increased by about 2,000 tons a week.

A £3,000,000 CONTRACT for two Scottish shipyards—one on the Clyde and the other at Leith—were announced last week by the Union Steamship Company, of New Zealand. This was followed next day by a contract, worth about £750,000, by a Norwegian firm with a Clyde shipyard for a 6,500 tons cargo ship. The orders bring the total number of vessels built by British shipyards for the New Zealand owners since the war to 25—a record which is believed to be unequalled by any other overseas' owner in the post-war period. Clydeside's share of the contract—for two cargo motorships, each of 5,300 tons—has been placed with Alex. Stephen & Sons, Limited, Glasgow. Three vessels, to be built by Henry Robb, Limited, Leith, will be slightly smaller.

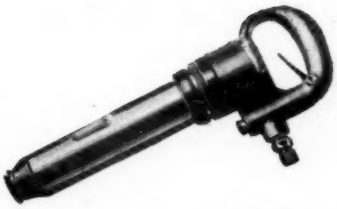
Holman

Matching the machine and the need

HOLMAN LEADERSHIP IN PNEUMATIC TOOL DEVELOPMENT

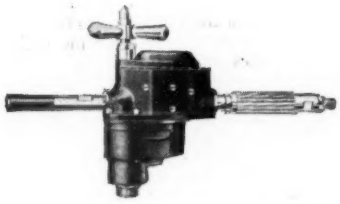
Unremitting research and experiment have enabled Holman Bros. to develop numerous fresh and effective applications of compressed-air power to the needs of industry. Pneumatic Tools made in Camborne can be seen at work in many of the world's best-known motor-car factories, railway works, shipyards, oil refineries and public works enterprises. In nearly every branch of industry, new needs have brought new and improved Holman Pneumatic Tools.

★ *Full particulars of all Holman Pneumatic Tools gladly sent on request.*



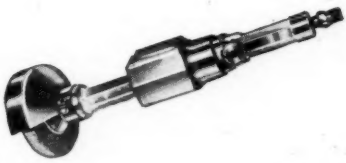
RIVETING HAMMERS

Noted for their easy control and vibration-free running. High-speed, powerful chipping and riveting hammers, with special main and auxiliary valves and extra-sensitive throttle. The range covers all classes of riveting.



ROTODRILLS

New Series—with interchangeable motors. Simply constructed, robust and free from vibration. Automatic lubrication. Reversing mechanism gives equal power in either direction, and a stalled drill can be restarted at once.



ROTOGRINDS

New Series—with interchangeable motors. Complete range of precision-grinding and heavy-duty tools for internal grinding, cleaning castings, polishing, buffing, scaling, fettling, etc. Simple, efficient, smooth-running, quiet. Straight and grip handles supplied.

BROS. LTD.
Holman
CAMBORNE. ENGLAND

TELEPHONE: CAMBORNE 2275 (9 LINES) TELEGRAMS: AIRDRILL, CAMBORNE

SUBSIDIARY COMPANIES, BRANCHES AND AGENCIES THROUGHOUT THE WORLD HC20

Raw Material Markets

Iron and Steel

The diminution in the volume of fresh business now being placed is still apparent in certain sections of the foundry trade, but it has not yet resulted in any appreciable decline in outputs. As mentioned in our last report, both home and export markets are affected by the reduced requirements. Castings for household equipment and for the textile trades show a marked decline, and some of the jobbing foundries find it imperative to seek for orders on a wider front. A few of the light foundries have insufficient business for their normal products to maintain production, but castings for the rearmament programme enhance their commitments.

Some of the engineering foundries connected with the motor and tractor trades report reduced forward bookings, due to lower exports. The light foundries connected with the building trades are well employed, with good prospects, and machine-tool makers are maintaining their demand for castings from the engineering and speciality foundries.

Generally there is a regular demand for the foundry grades of pig-iron. The engineering and speciality foundries are taking up their permitted allocations of the low- and medium-phosphorus irons and hematite. Supplies of high-phosphorus pig-iron do not exceed requirements, outputs being depleted by the reduced number of furnaces now in blast on account of repairs and re-lining. In fact, many foundries complain that their allocations barely cover current needs, and, of course, leave nothing for stock.

Scrap supplies for the foundries continue to be stringent, particularly for the heavy and better grades, but the supply of light scrap has improved. Foundry coke is coming forward regularly, while ganister, limestone, and firebricks are available quite freely.

The re-rollers continue to be much better supplied with steel semis, mostly from abroad, and their outputs of light sections, bars, and strip have increased proportionately. Deliveries of steel semis from home sources show little improvement, and the allocations for Period IV do not allow for increased tonnages. Orders from home consumers provide the major portion of their work, export business being very restricted. The sheet re-rollers are very busy; home demands are good, while they have plenty of work for oversea buyers. They continue to receive larger consignments of sheet bars from abroad and they are thus able to record higher outputs.

Non-ferrous Metals

The London Metal Exchange reopened for dealings in lead yesterday (Wednesday), on which day further relaxations in metal controls were introduced. Licences will no longer be required for the acquisition and use of:—Lead; lead alloys; lead scrap and residues; remelted zinc; zinc alloys; zinc scrap and residues; copper scrap and residues; copper alloy scrap and residues. Licences will still be required for the acquisition of unwrought copper and virgin zinc, and copper and zinc ores and concentrates. The restrictions on the use of copper and copper alloys in the manufacture of certain articles remain in force.

The official closing price of refined pig-lead for both October and January positions was £107 10s. to £108 per ton. This compares with the Government's recent controlled price of £131 per ton and with £16 10s. per ton when the lead market was closed 13 years ago.

At the beginning of last week the Ministry of Materials made a reduction of £4 in the zinc price to £122, following the levelling out of the American quotation at 14 cents. Since then further weakness has developed in the U.S. figure, which, at the time of writing, stands at 13.50 to 14 cents, one Custom smelter having cut the price by ½ cent. Whether demand across the Atlantic is so poor that the producers will follow this downward trend is not at present apparent, but in the meanwhile the U.S. Government has announced its intention of buying zinc for stockpiling and has said that it will pay 13½ cents for supplies. Fundamentally, the outlook for zinc does not appear to be very propitious, for stocks are high, both in the United States and on this side also, and demand is none too good. On the other hand, it seems very likely that at the present price level a certain number of properties find that their costs are too high to make production a paying proposition, and therefore output may fall. This, however, will take time to have an effect and, in the meanwhile, it would not be at all surprising if the quotation were to move down to a lower level.

Aluminium seems to be another metal in which stocks are growing, but, nevertheless, for some time past there has been talk of a possible price increase in the U.K. As the bulk of our supplies come from Canada it is reasonable to suppose that the strength of the Canadian dollar may have some connection with this suggestion.

Trading in tin has been moderately active; the following are the official prices on the London Metal Exchange:—

Cash—Thursday, £957 10s. to £959; Friday, £963 to £964; Monday, £961 to £962; Tuesday, £961 to £962; Wednesday, £964 to £966.

Three Months—Thursday, £947 10s. to £948 10s.; Friday, £952 to £953; Monday, £950 to £951; Tuesday, £951 to £952; Wednesday, £955 to £956.

Work for Coltness Foundrymen?

The Ministry of Supply is to be asked by the Scottish T.U.C. to take over the Coltness Iron Company's foundries at Newmains, Lanarkshire, and thus preserve the jobs for the 640 workers threatened with redundancy. This action has been decided on by the General Council of the Scottish T.U.C. following the announcement that the firm's decision to close the works is final, and despite the fact that the foundries have been offered for sale as a "going concern." Mr. George Middleton, general secretary of the Scottish T.U.C. explained last week that the Council feel that, if the Ministry of Supply cannot take over the plant and use it for armament purposes, they do not see any chance of a private firm doing so.

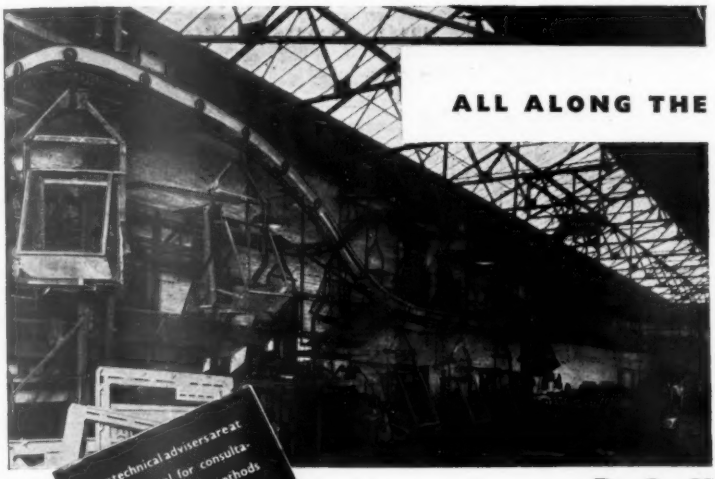
Reduction of Dust and Fumes

Mr. Neville B. Rutherford has drawn attention to some corrections needed in the version of his remarks at the Harrogate Conference given on p. 363 of the JOURNAL for September 25:—

(1) Lines 6 and 7 should read: ". . . aware that an alternative method employing nitrogen was applicable . . ."

(2) Line 26 should read: " some carbon tetrachloride in gaseous . . ."

(3) Line 32: "carbon tetrachloride" should read "hexachlorethane."



ALL ALONG THE LINE . . .

this Rownson overhead chain conveyor helps to maintain a steady flow of production.

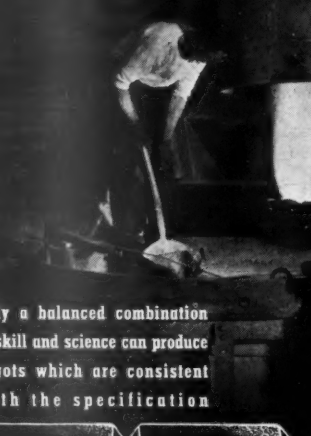
Our technical advisers are at your disposal for consultation on improved methods of materials handling.

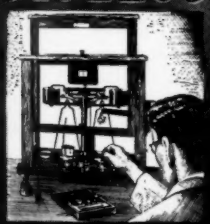
ROWNSON DREW AND CLYDESDALE LIMITED

HEAD OFFICE: 225 UPPER THAMES ST., LONDON, E.C.4.
Telephone: GULliver 4418. Cables: Rownson, London.
WORKS: MAIDEN LANE, YORK WAY, KING'S CROSS, LONDON, N.7.

Manufacturers of Belt, Slat, Chain and Portable Band Conveyors, Stackers and Humpers, Swing Tray Elevators, Portable Platform Hoists
RDC 3170

NON-FERROUS INGOTS UNDER CONTROL





Only a balanced combination of skill and science can produce Ingots which are consistent with the specification

LEOPOLD LAZARUS LTD

CREECHURCH HOUSE, CREECHURCH LANE, LONDON E.C.3. Tel. AVENUE 5341
WORKS: ST. STEPHEN'S STREET, ASTON, BIRMINGHAM 6. Tel. ASTON CROSS 3115
CHRONICLE BUILDINGS, CORPORATION STREET, MANCHESTER 4. Tel. BLACKFRIARS 3741
PEMBROKE BUILDINGS, PIER STREET, SWANSEA. Tel. SWANSEA 4015

Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered, unless otherwise stated*)

October 1, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 17s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. S), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £14 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 4s. 6d.; South Zone, £17 7s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £17 14s. 6d.; South Zone, £17 17s.

Cold Blast.—South Staffs, £18 2s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £13 11s. 6d.; Scotland (Scotch iron), £13 18s.; Sheffield, £14 12s. 6d.; Birmingham, £14 19s.; Wales (Welsh iron), £13 18s.

Basic Pig-iron.—£12 10s. all districts.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered.*)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 22s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204; ditto, copper-free, £212.

Ferro-tungsten.—80/85 per cent., 28s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 31s. 7d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 6s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £43 15s. 2d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £41 12s. 6d.; galvanized corrugated sheets, 24 g., £53 6s. 6d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 7s. 9d.; nickel-chrome-molybdenum, £79 2s. 6d.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £964 to £966; three months, £955 to £956; settlement, £965.

Zinc.—G.O.B. (foreign) (duty paid), £122; ditto (domestic), £122; "Prime Western," £122; electrolytic, £126; not less than 99.99 per cent., £128.

Lead.—Refined pig-lead October, £107 10s., to £108; January, £107 10s. to £108.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £142 15s.; rolled zinc (boiler plates), all English destinations, £140 15s.; zinc oxide (Red Seal), d/d buyers' premises, £148.

Other Metals.—Aluminium, ingots, £157; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £64 10s. to £64 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 27½d. per lb.; rods, drawn, 37½d.; sheets to 10 w.g., 31¾d.; wire, 33d.; rolled metal, 30d.

Copper Tubes, etc.—Solid-drawn tubes, 32⅜d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £198 to £218; BS. 1400—LG3—1 (86/7/5/2), £218 to £238; BS. 1400—G1—1 (88/10/2), £345 to £375; Admiralty GM (88/10/2), virgin quality, £375 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £355 to £385; L.P.Bl, £250 to £275 per ton.

Phosphor Bronze.—Strip, 44d. per lb.; sheets to 10 w.g., 46½d.; wire, 49½d.; rods, 44½d.; tubes, 42½d.; chill cast bars: solids 4s. 4d., cored 4s. 5d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9½d. per lb.(7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3½d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 3¾d. to 4s. 4¼d.; to 25 in. wide × .056, 3s. 5¾d. to 4s. 6½d. Spoon and fork metal, unsheared, 3s. 0½d. to 4s. 1½d. Wire, 10g., in coils, 3s. 9¾d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 8¾d.; 15%, 4s. 2d.; 18%, 4s. 6½d. All prices are net.